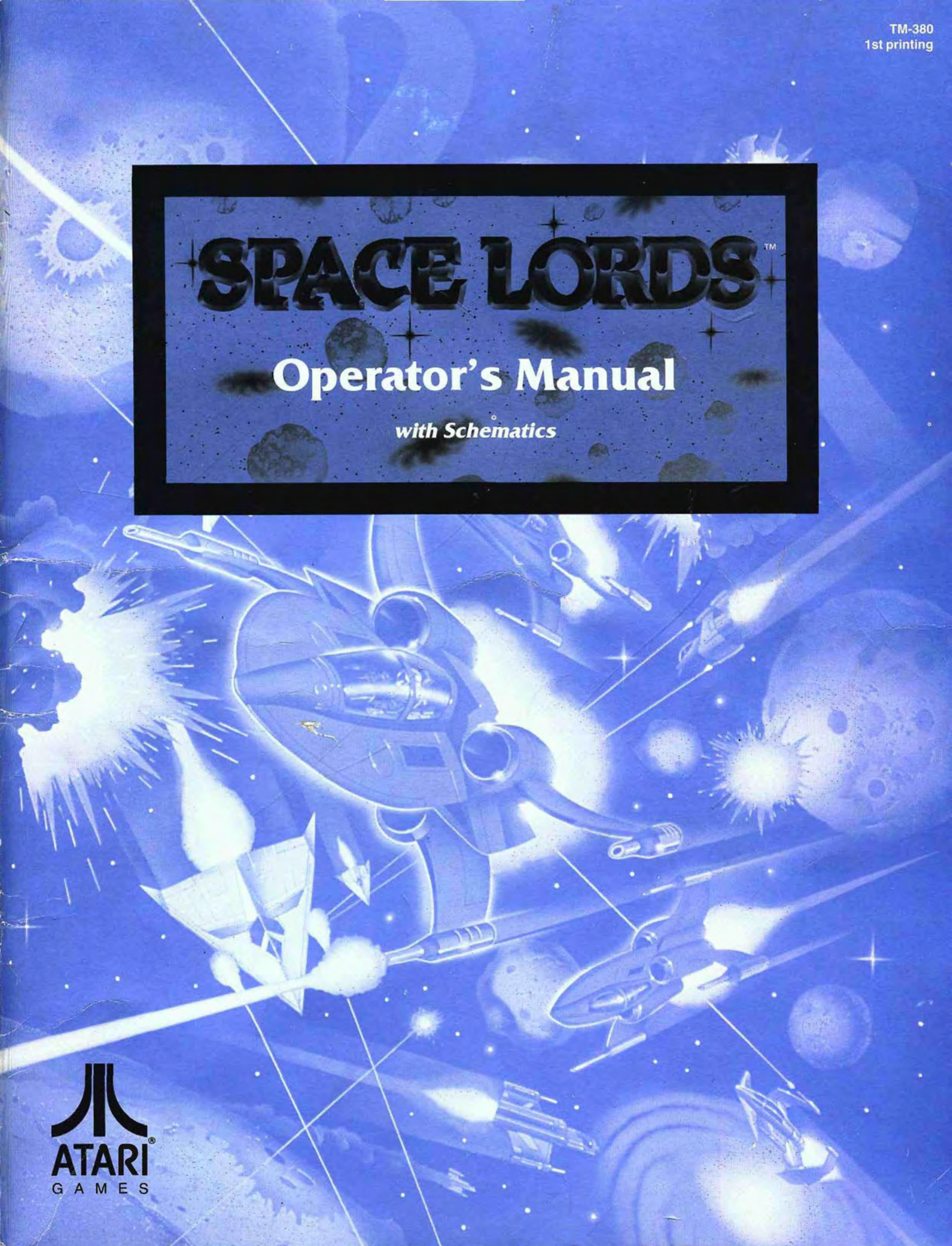
TM-380
1st printing

SPACE LORDS™

Operator's Manual

with Schematics



ATARI® GAMES

For technical assistance:

If reading through this manual does not lead to solving your game maintenance or repair problem, call TELE-HELP® at one of these Atari Games Customer Service offices:

United States

Atari Games Corporation
California Customer Service Office
737 Sycamore Drive
Milpitas, CA 95035
Fax (408) 434-3945
Telex 5101007850
✆ (408) 434-3950
(Monday–Friday, 7:30 a.m.–4:00 p.m. Pacific time)

Europe

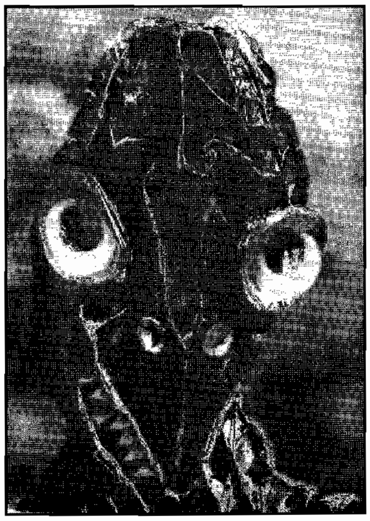
Atari Games Ireland Limited
European Customer Service Office
Tipperary Town, Ireland
Fax 062-51702
Telex 70665
✆ 062-52155
(Monday–Friday, 9:00 a.m.–5:30 p.m. GMT)

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Patent is pending on several parts of the Space Lords game



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Illustration & Design: Mary Ohanessian Sumner

NOTICE RE NON-ATARI® PARTS

WARNING

Use of non-Atari parts or modifications of any Atari game circuitry may adversely affect the safety of your game, and may cause injury to you and your players.

You may void the game warranty (printed on the inside back cover of this manual) if you do any of the following:

- Substitute non-Atari parts in the game.
- Modify or alter any circuits in the game by using kits or parts *not* supplied by Atari Games Corporation.

NOTE

This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of Federal Communications Commission (FCC) Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area or modification to this equipment is likely to cause interference, in which case the user, at his own expense, will be required to take whatever measures may be required to correct the interference. If you suspect interference from an Atari game at your location, check the following:

- All ground wires in the game are properly connected as shown in the game wiring diagram.
- The power cord is properly plugged into a grounded three-wire outlet.
- On games provided with an Electromagnetic Interference (EMI) ground plane, be sure that the game printed-circuit boards (PCBs) are properly installed on the EMI ground plane and that the end board is securely installed with **all** screws in place and tightened.

If you are still unable to solve the interference problem, please contact Customer Service at Atari Games Corporation. See the inside front cover of this manual for service in your area.

Safety Summary

The following safety precautions apply to all game operators and service personnel. Specific warnings and cautions will be found in this manual whenever they apply.

WARNING

Properly Ground the Game. Players may receive an electrical shock if this game is not properly grounded! To avoid electrical shock, do not plug in the game until it has been inspected and properly grounded. This game should only be plugged into a grounded three-wire outlet. If you have only a two-wire outlet, we recommend you hire a licensed electrician to install a three-wire grounded outlet. If the control panel is not properly grounded, players may receive an electrical shock! After servicing any part on the control panel, check that the grounding wire is firmly secured to the control panel. After you have checked this, lock up the game.

AC Power Connection. Before you plug in the game, be sure that the game's power supply can accept the AC line voltage in your location. The line voltage requirements are listed in the first chapter of this manual.

Disconnect Power During Repairs. To avoid electrical shock, disconnect the game from the AC power before removing or repairing any part of the game. If you remove or repair the video display, be very careful to avoid electrical shock. High voltages continue to exist even after power is disconnected in the display circuitry and the cathode-ray tube (CRT). Do not touch the internal parts of the display with your hands or with metal objects! Always discharge the high voltage from the CRT before servicing it. Do this after you disconnect it from the power source. First, attach one end of a large, well-insulated, 18-gauge jumper wire to ground. Then momentarily touch the free end of the grounded jumper wire to the CRT anode by sliding the wire under the anode cap. Wait two minutes and do this again.

Use Only Atari Parts. To maintain the safety of your Atari game, use only Atari parts when you repair it. Using non-Atari parts or modifying the game circuitry may be dangerous, and could injure you and your players.

Handle the CRT With Care. If you drop the CRT and it breaks, it may implode! Shattered glass from the implosion can fly six feet or more.

Use the Proper Fuses. To avoid electrical shock, use replacement fuses which are specified in the parts list for this game. Replacement fuses must match those replaced in fuse type, voltage rating, and current rating. In addition, the fuse cover must be in place during game operation.

CAUTION

Properly Attach All Connectors. Make sure that the connectors on each printed circuit board (PCB) are properly plugged in. The connectors are keyed to fit only one way. If they do not slip on easily, do not force them. If you reverse a connector, it may damage your game and void your warranty.

Ensure the Proper AC Line Frequency. Video games manufactured for operation on 60 Hz line power (used in the United States) must not be operated in countries with 50 Hz line power (used in Europe). If a 60 Hz machine operates on 50 Hz line power, the fluorescent line ballast transformer will overheat and cause a potential fire hazard. Check the product identification label on your machine for the line frequency required.

ABOUT NOTES, CAUTIONS, AND WARNINGS

In Atari publications, notes, cautions and warnings have the following meaning:

NOTE — A highlighted piece of information.

CAUTION — Equipment and/or parts can be damaged or destroyed if instructions are not followed. You will void the warranty on Atari printed-circuit boards, parts thereon, and video displays if equipment or parts are damaged or destroyed due to failure of following instructions.

WARNING — Players and/or technicians can be killed or injured if instructions are not followed.

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1 Set-Up

2 Self-Test

3 Troubleshooting and Maintenance

4 Parts Illustrations

For figure and page numbers, see the list of illustrations that follows.

5 Schematics

See the list of illustrations that follows.

Statistics Sheet

After the end of this manual

Warranty

Inside back cover

ILLUSTRATIONS

TABLES

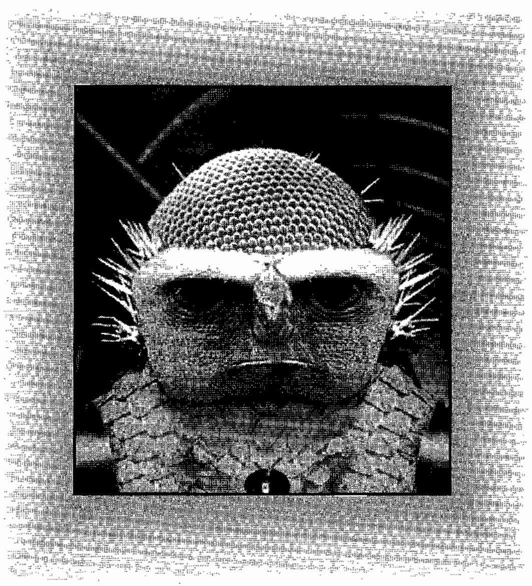


NOTES

Set-Up

How to Use This Manual

THIS MANUAL IS written for operators and service personnel. It provides information for setting up, playing, testing, and maintaining your Space Lords™ game. ♦ Space Lords is a one- to four-player outer-space warfare game that simulates 3D and allows players full navigational control. To maximize earnings, you can link two upright cabinets together so that as many as eight players can compete head-to-head. To do so, a separate link kit is available from your authorized Atari distributor for a nominal fee. ♦ Chapter 1 of this manual contains set-up and game play information. ♦ Chapter 2 contains a description of the self-test procedures and option settings. The self-test is important in the Space Lords game. You can troubleshoot the printed-circuit boards (PCBs), main circuits, and controls using the screens in the self-test. You should regularly test the boards and controls with the self-test to keep your game in peak condition and at top earnings. ♦ Chapter 3 contains several troubleshooting tables, plus maintenance and repair procedures for the game components. If you have problems with your game, use this chapter to troubleshoot and repair it. Be sure to perform the preventive maintenance tasks to keep your game in good condition. ♦ Chapter 4 contains the illustrations and PCB parts lists. ♦ Chapter 5 contains the schematics for all the PCBs and all the wiring diagrams.



Operating the Game

To operate your game for maximum income, you should regularly run the self-test and check the controls with the Control Test and Sound Test in the self-test. By using the self-test regularly, you can find and fix problems immediately. This lets you keep your game in top condition.

Inspecting the Game

WARNING

To avoid electrical shock, do not plug in the cabinet until it has been properly inspected and set up for the line voltage in your area.

This cabinet should be connected to a grounded three-wire outlet only. If you have only two-wire outlets, we recommend that you hire a licensed electrician to install grounded outlets. Players can receive an electrical shock if the cabinet is not properly grounded.

Make note of the power consumption when you set up this game, so that you do not overload your electrical circuit. See Table 1-1 for the power consumption and the other important specifications of this game.

Inspect your Space Lords game carefully to ensure that the game is complete and was delivered to you in good condition. Inspect the cabinet and seat as follows:

1. Examine the exterior of the cabinet for dents, chips, or broken parts.
2. Open the lower rear access panels. Unlock and open the coin doors. Inspect the interior of the cabinet as follows:
   a. Check that all plug-in connectors on the cabinet harnesses are firmly plugged in. Do not force connectors together. The connectors are keyed so they fit only in the proper orientation. A reversed connector can damage a printed-circuit board (PCB). This will void your warranty.
   b. Ensure that all plug-in integrated circuits on each PCB are firmly plugged into their sockets.
   c. Inspect the power cord for any cuts or dents in the insulation.
   d. Inspect the power supply. Make sure that the correct fuses are installed. Check that the harness is plugged in correctly. Check that the green ground wires are connected.

Characteristic	Specification
Input Current	3.1 Amps at 120 V
Line Fuse Rating	4 Amps at 120 V, slow blow
Line Voltage	102 to 132 VAC
Temperature	5° to 38° C (37° to 100° F)
Humidity	Not to exceed 95% relative
Width	53 inches (134.6 cm)
Depth	34.5 inches (87.6 cm)
Height*	74 inches (188 cm)
Weight	580 lbs. (263 kg)

**Including the wood attraction-sign housing*

Table 1-1 Game Specifications

   e. Inspect other sub-assemblies, such as the video displays, controls, printed-circuit boards, and speakers. Make sure that they are mounted securely and that the ground wires are connected.

Control and Switch Locations

All of the controls are located on the back of the cabinet or behind the coin doors (see Figure 1-1). The following describes the locations in more detail:

Power On/Off Switch

The power on/off switch is located on the bottom right rear panel of the cabinet, below the right rear access panel.

Volume Control

There is no volume adjustment knob on any PCB in this game. Instead, volume is separately adjusted in the self-test for each side. Refer to Chapter 2 of this manual for more information.

Self-Test Swltch and Bracket

There is one self-test switch, mounted on a bracket behind the right coin door. This self-test switch controls both screens.

Although there is an additional self-test switch located on each GX2 (game) PCB, for convenience we recommend that you use the coin door self-test switch.

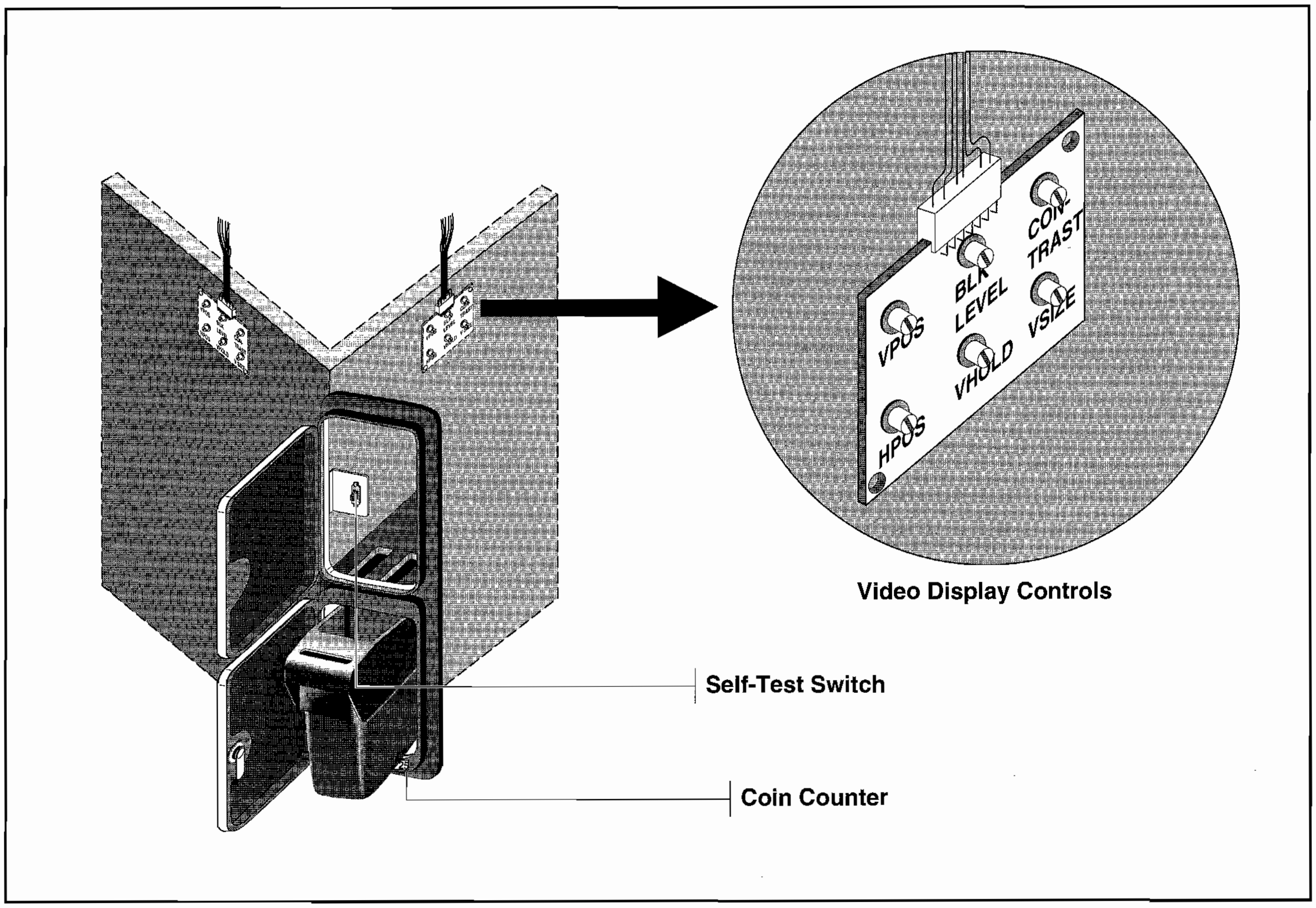


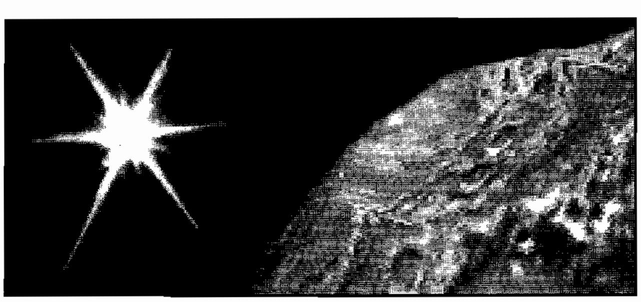
Figure 1-1 Main Control and Switch Locations

Coin Counters

The coin counters are located near the bottom of each coin box, inside each coin door.

Video Display Controls

This game provides convenient access to six of the most important video display controls — vertical and horizontal position, vertical hold, vertical size, black level, and contrast. These control knobs are on small PCBs that are mounted on the plywood panel inside each coin door (see Figure 1-1).



Setting the Coin and Game Options

The Space Lords coin and game options are set in the self-test. Refer to Chapter 2 for the recommended settings and the procedure for setting the options.

Game Play

This section describes the features and play of the Space Lords game.

Introduction

Man your battlestations! Take a journey among fields of asteroids and gaseous nebulae to the battlefields of the future. Here aliens from across the universe congregate to prove who is the most feared pilot in space.

Space Lords is a unique engineering feat that allows players a glimpse into the unknown world of space warfare. In a true 3-D universe, game players have full navigational control of their spacecraft. Armed with lasers and nukes, players engage in tactical dogfights with other players and a variety of alien spacecrafts.

In a futuristic two-monitor cabinet, one to four players can play either pilot or co-pilot stations. A low-cost link kit is available to link two cabinets together for four-screen, eight-player games. This format enhances the interactive and competitive features of the game.

Game Play

Players can select from three game modes:

- Solo — Mission-based game. Players must destroy a specified number of alien ships to advance to the next mission. In each mission players face different enemies, requiring different strategies.
- Team — Players form red and blue teams and compete in a team format.
- Melee — The ultimate dogfight in outer space. A free-for-all where survival of the fittest is the rule.

The pilot's controls consist of a throttle for speed/-direction, flight controller to steer, and a start/hyper-space button. In addition to variable forward/back-ward positions, the throttle has a rear view button to see behind the ship. Players can fly in one direction, yet shoot in the other.

On the flight controller are both laser (trigger/index finger) and nuke (thumb) fire buttons. Lasers are unlimited, unlike nukes. Nukes can be acquired from the "Modify Ship" screen while selecting the game mode, or collected in space through the green bonus satellites. A red Hyperspace button on the control panel serves as a quick escape when the action is getting too intense.

The co-pilot, too, has a flight controller and serves as a second gunner, giving the ship double firepower. Like the pilot, the co-pilot also has a hyperspace button. A special cloaking button makes the ship undetectable by enemy radar. Cloaking, however, consumes energy faster than usual.

Pressing both the hyperspace and cloak buttons engages Turbo Cloak, making the ship undetectable and fast. As a bonus to encourage tandem play, the pilot/co-pilot's ship is awarded extra energy, increased firepower, increased turning ability, an extra life, an extra nuke, and an extra hyperspace.

In the Game Mode select screen, players have the ability to modify their ship to their specifications. They can adjust any or all of the following:

- Nukes — Long-range high-power weapon
- Hyperspaces — Quick boost to safety
- Shields — Protection from enemy blasts and collisions
- Laserpower — Strength of player's laser
- Agility — Ship acceleration and responsiveness of the flight control
- Speed — Top-end speed

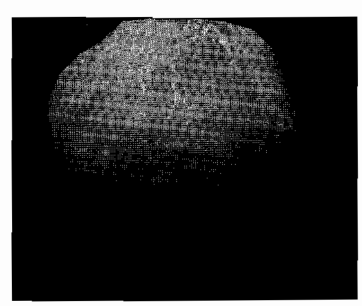
After getting some experience, players understand how to modify their ship depending on the opponent(s) they face.

Eight different alien enemies are in the universe. They include the Troid, Octon, Raptor, Hydrus, Krystar, Xyclops, Nakar and Noptera. Each of these enemies flies unique-looking ships and possesses different flight characteristics.

An on-screen radar identifies enemy ship locations. Dots on the screen indicate the location of enemies: the brighter the dot, the closer the enemy. Using a combination of both throttle and flight controller, a player can steer towards or away from a specific ship(s). On the instruction label, a diagram explains how to use the radar.

Green satellites in space are good and benefit the player. By collecting these (flying through them), players can collect energy, nukes, hyperspaces, and even an extra life. A "?" satellite can award a variety of special bonuses. Players should always collect these when they are easily available.

At the top of the screen, a player's "Kills" and "Kill Rating" is displayed. Kills are simply a numerical record of all ships downed by the player. In the Solo/Missions mode, it displays the number of ships left to kill. The Kill Rating is a skill rating based on the number of game credits used.

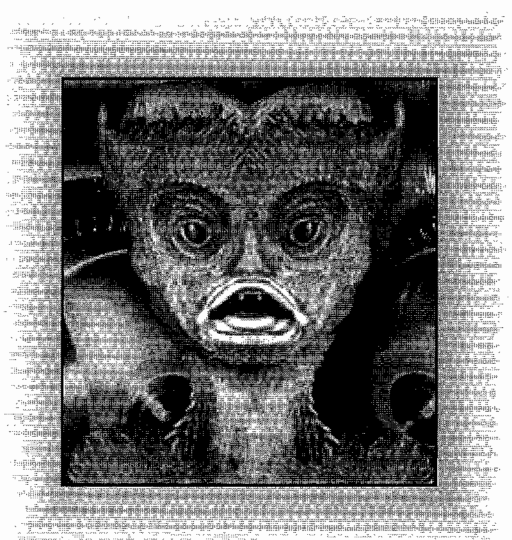


The strip lights go on during game play whenever a player is hit by laser or nuke shots. They are also used in the attract mode to draw players' attention.

Self-Test

Introduction

USE THE SPACE LORDS™ self-test to check the condition of the game circuitry and controls. You will see the self-test information on the video display and hear the sound test information through the speakers. You do not need any additional equipment to perform the self-test. Perform the self-test when you first set up the game, each time you collect the money, or when you suspect game problems. This chapter shows the screens in the self-test and explains each of the tests. The screens and explanations are arranged in the order they appear in the self-test. Table 2-1 lists all the self-test screens.



Entering and Exiting the Self-Test

The game's self-test switch is conveniently located behind the right coin door. Turning it on causes both screens to enter the self-test mode. Doing so displays the Select Test menu; see Figure 2-1. Exit the self-test by turning off the self-test switch at any time.

Select Test Menu
Adjust Volume
Statistics Statistics System Error Counts Time Per Life for Solo Time Per Life for Team Time Per Life for Melee Session Times
Game Options
Coin Options
Controls Test
Sound Board Test
Link Test
RAM Tests Video RAM Color RAM Working RAM Common RAM (2) All RAM
ROM Test
Alphanumeric Test
Motion Object Tests Motion Object Checksums Motion Object Growth Test
Playfield Tests Scrolling Test Stamp Test
Monitor Tests Video Sync Test Color Test Purity Test Convergence Test

Table 2-1 Summary of All Self-Test Screens

Strip Lights

When the right-hand side is anywhere in the Select Test menu, both lights should be on. When the right-hand side enters a specific test from the Select Test menu, both strip lights should be turned off. The strip lights go on during game play whenever a player is hit by laser or nuke shots. They are also used in the attract mode to draw players' attention.

Select Test Menu

Choose which test or screen you want to see from this menu, shown in Figure 2-1. Note that this picture shows the *full* test selection screen, which only appears on the right video display in each game. The left display shows fewer tests. Therefore, the right display acts as a "master" self-test screen.

Move up and down the menu by moving the left joystick forward or backward (or by pressing the thumb button). Start the selected test by pressing the trigger button.

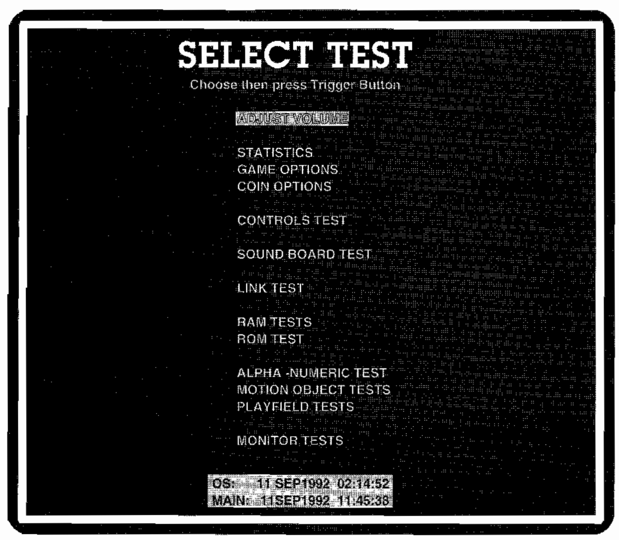


Figure 2-1 Select Test Menu Screen

Adjust Volume

Adjust the volume of the game using this screen, shown in Figure 2-2. Follow the instructions at the bottom of the screen to change the volume, to restore the old volume level, and to save the new volume and return to the select test menu.

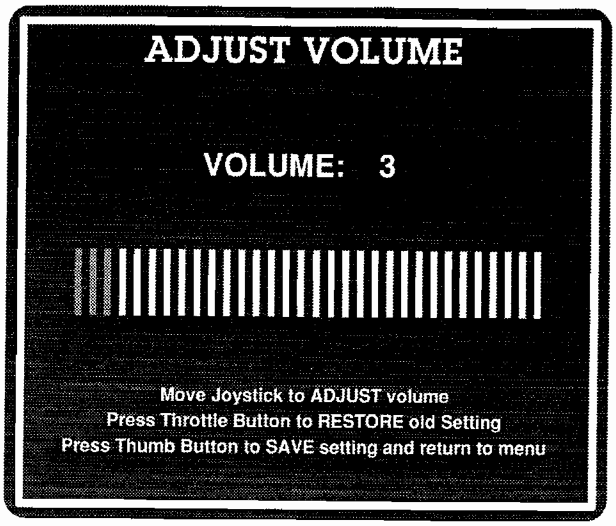


Figure 2-2 Adjust Volume Screen

Statistics

Use the information shown in the statistics and histogram (bar graph) screens to keep track of your game use and maximize your profits. Record the information on the Space Lords statistics page in the back of this manual. The first of the screens is shown in Figure 2-3. (Make several extra copies of this form before writing on it!)

The game statistics are collected from the last time the statistics were cleared. Follow the instructions at the bottom of the screen to clear the statistics or to advance to the next statistics or histogram screen.

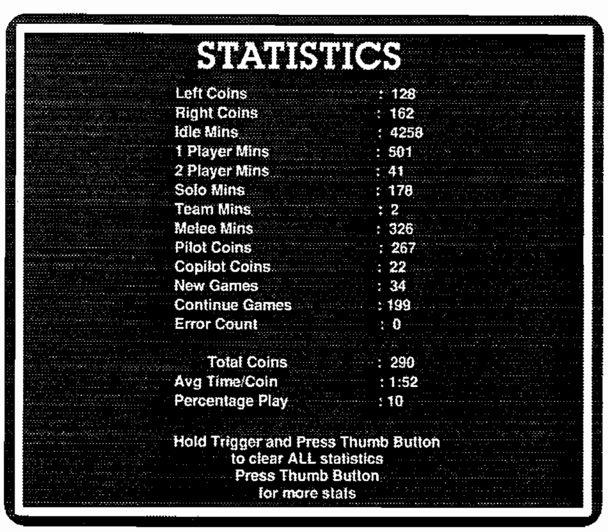


Figure 2-3 Statistics Screen

Statistics Screen

The statistics screen lists the following information:

- Left Coins shows the number of coins counted in the left coin mechanism.
- Right Coins shows the number of coins counted in the right coin mechanism.
- Idle Minutes shows the number of minutes that the game was idle and not being played.
- 1 Player Minutes shows the number of minutes that the game was played by one player only.
- 2 Player Minutes shows the number of minutes that the game was played by two players.
- Solo Minutes shows the number of minutes that the game was played in solo mode (a mission-based game).
- Team Minutes shows the number of minutes that the game was played in the team mode.
- Melee Minutes shows the number of minutes that the game was played in the melee (free-for-all) mode.
- Pilot Coins shows the number of coins counted in the left mechanism of each coin door.
- Copilot Coins shows the number of coins counted in the right mechanism of each coin door.
- New Games shows the number of unique games played. A unique game is counted every time a player starts a new game (not a continued game).
- Continue Games shows the number of games that players continued.
- Error Count shows the number of errors counted in the erasable memory. If you have an error count, the statistics may be wrong. If you consistently have errors counted for several weeks, replace the EEROM at 13C on the Space Lords game PCB.
- Total Coins shows the number of coin accumulated by the game in all coin slots.
- Average Time per Coin is displayed in seconds. This is tabulated for all games played since the statistics were cleared. If there are no credits, this line will not be displayed.
- Percentage Play shows the percentage of time played vs. the total time the game was turned on.

System Error Counts

This screen shows several important statistics regarding system errors. You should have zero or near zero shown after all numbers.

Remaining Histogram Screens

The remaining four screens show time per life for solo, time per life for team, time per life for melee, and session times. The first three of these screens show the number of games played, grouped in 30-second increments, but the session times are shown in minutes.

The bottom of each screen shows the median game time for that mode. The median value means half the games were above that value and half below.

Game Options

Check and select the game options on this screen, shown in Figure 2-4. The screen shows the factory default settings in green.

To move through the options, to change or save the settings, or to return to the select test menu, follow the instructions shown at the bottom of the screen. The game options, with defaults, are shown and explained in Table 2-2.

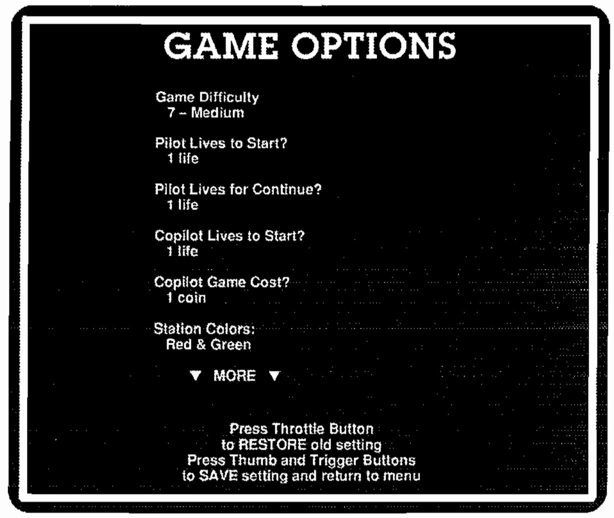


Figure 2-4 Game Options Screen

Coin Options

Check and select the coin options on this screen, shown in Figure 2-5. The screen shows the factory default settings in green.

Option	Available Settings	Explanation
Difficulty Level	0 – Easiest ... 7 – Medium ✔ ... 15 – Hardest	Sets the game difficulty for both the left and right screens.
Pilot Lives to Start?	1 life ✔ 2 lives 3 lives 4 lives	Determines how many lives are granted whenever a game is started.
Pilot Lives for Continue?	1 life ✔ 2 lives 3 lives 4 lives	Determines how many lives are granted whenever a game is continued.
Copilot Lives to Start?	1 life ✔ 2 lives 3 lives 4 lives	Determines how many lives are granted whenever a game is started.
Copilot Game Cost?	1 coin ✔ 2, 3, 4, 5, 6, 7, 8 coins	Determines how many coins are required to start a co-pilot game.
Station Colors?	Red & Green ✔ Blue & Yellow	Red & Green are the default colors of the players' spaceships on the screen. If you link two games together, set this option to Blue & Yellow on the second linked game.
Attract Music Frequency	No Music, Less Frequent, Frequent ✔, Very Frequent	Lets you turn the sound off in the attract mode, or adjust how often the attract music plays.
Auto High Score Reset	Yes ✔ No	Automatically clears the high score table periodically.
Reset High Score Table?	Yes ✔ No	Clears the high score table the next time you select the game mode.
Restore Factory Default?	Yes No ✔	Returns all the game options to the green factory defaults.

✔ *Manufacturer's recommended settings*

Table 2-2 Game Option Settings

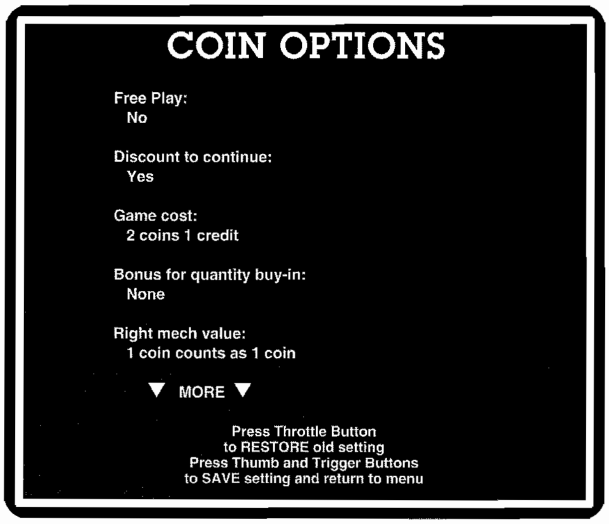


Figure 2-5 Coin Options Screen

To move through the options, to change or save the settings, or to return to the select test menu, follow the instructions shown at the bottom of the screen. The coin option settings, with defaults, are shown and explained in Table 2-3.

Controls Test

NOTE

The coin switches are checked in the Sound Board test. See the section that follows in this chapter.

The control test screen is shown in Figure 2-6. This test checks all the pushbutton switches, the joystick potentiometers, and the throttle switches. As you use each control, the numbers for the joystick pots increase or decrease, or the switch names are highlighted. If the changes do not appear on the screen, check the controls and their wiring. Follow this procedure:

1. Simultaneously press the trigger and thumb buttons to reset the joystick pot limits; the center numbers will turn red. Then push the joystick into the four corners to set the maximums and minimums. Make sure that the green numbers correspond to the changes. The upper left corner corresponds to the lower numbers.

Option	Available Settings	Explanation
Free Play	No ✔ Yes	Lets you choose free play to demonstrate the game.
Discount to Continue	No Yes ✔	When set to *Yes*, this option reduces by 50% the player's cost to continue a game (always rounded up to the next full coin).
Game Cost	1 coin 1 credit 2 coins 1 credit ✔ ... 8 coins 1 credit	The number of coins required for one credit.
Bonus for Quantity Buy-in	None ✔ 2 coins give 1 3 coins give 1 3 coins give 2 4 coins give 1 ... 9 coins give 2 9 coins give 3	Lets you choose from various kinds of bonuses or no bonus.
Right Mech Value	1 coin counts as 1 coin ✔ 1 coin counts as 2 coins ... 1 coin counts as 7 coins 1 coin counts as 8 coins	The number of coins each coin counts as in the right coin mechanism.
Left Mech Value	1 coin counts as 1 coin ✔ 1 coin counts as 2 coins ... 1 coin counts as 7 coins 1 coin counts as 8 coins	The number of coins each coin counts as in the left coin mechanism.

✔ *Manufacturer's recommended settings*

Table 2-3 Coin Option Settings

If the center numbers stay red as you move the joysticks into the four corners, this indicates the pots do not have enough range.

If the minimum and maximum numbers are too close to zero or too close to 255, then the minimum and maximum numbers are displayed in red. The pots should be replaced if any numbers stay red.

2. Press each button on the control panel. Make sure that the corresponding message is highlighted on the screen.

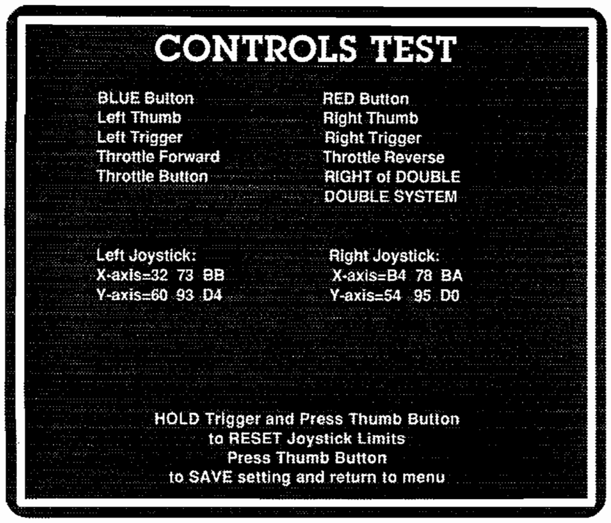


Figure 2-6 Controls Test Screen

Press the left thumb button to return to the select test menu.

Sound Board Test

The sound test indicates the condition of the sound effects circuit on the game PCB. The sound test screen appears in Figure 2-7.

NOTE

The Audio PCB must be installed and connected in the game to perform this test.

To select a sound, to play a sound, or to return to the select test menu, follow the instructions shown at the bottom of the screen. (You can have numerous sounds playing simultaneously, or you can have silence, depending on which ones you select.) Pressing the throttle button will stop all sounds.

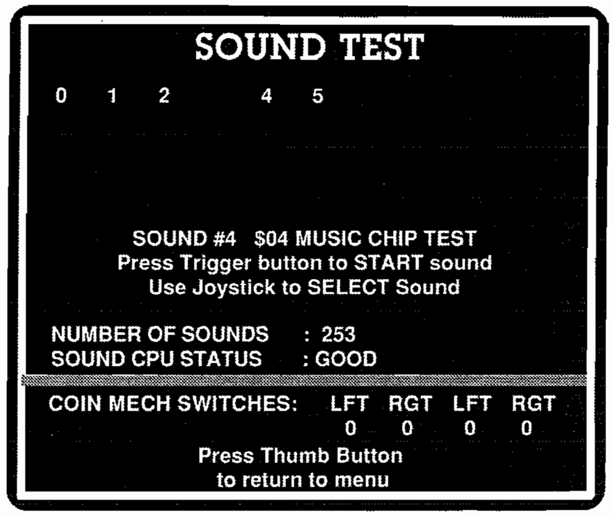


Figure 2-7 Sound Test Screen

Verify that the Sound CPU status is good. Also press the left and right coin mechanism switches: the *0* on the screen should change to a *1* while you press the corresponding switch. Note that the leftmost group of LFT and RGT coin mech messages will be displayed *only* if you have linked two cabinets together.

Link Test

The link test checks the link between two Space Lords games (see Figure 2-8).

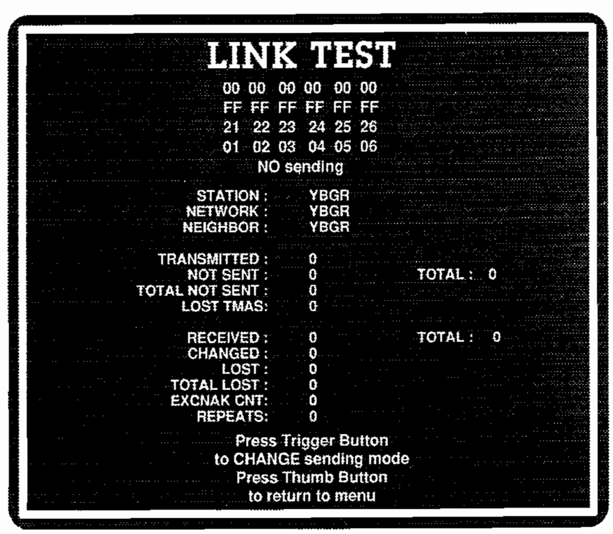


Figure 2-8 Link Test Screen

Once both linked games are in the Link Test, START "ASYNCHRONOUS SENDING" by pressing the pilot trigger on each cabinet. The most important numbers

to look at are *TOTAL NOT SENT* and *TOTAL LOST.* Both of these numbers should be zero or a very low number, and should not be increasing.

NOTE

A link problem can remain hidden and unsolved if you do not check both linked cabinets.

If incorrect data is received in any of these cable tests, the failure will appear in red. You may have a problem with the cable, plug, harnesses, or connectors.

NOTE

Do not run this test if a connected/linked game is not in Self-Test.

RAM Tests

Use this selection screen, shown in Figure 2-9, to run any of the six RAM tests. These tests check the RAM chips in various ways.

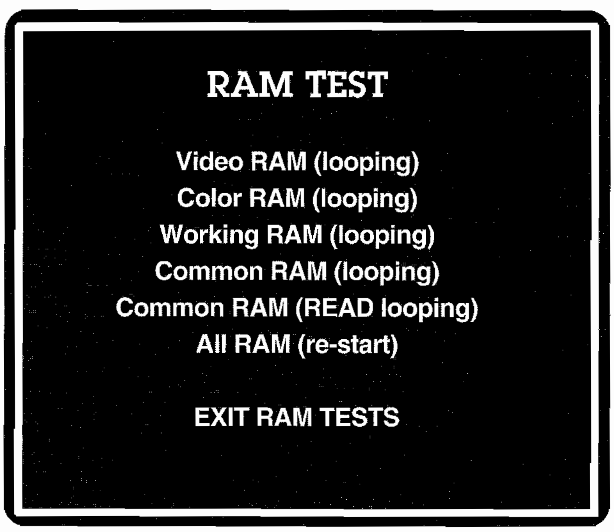


Figure 2-9 RAM Test Screen

ROM Test

Use this selection screen, shown in Figure 2-10, to see if the ROMs are OK. When you turn on the power, the game automatically runs through the random-access memory (RAM) and read-only memory (ROM) test. Regardless of whether or not the game has a problem, it will always advance to the attract mode. The game will stop only if you power it up and the self-test switch has been previously turned on.

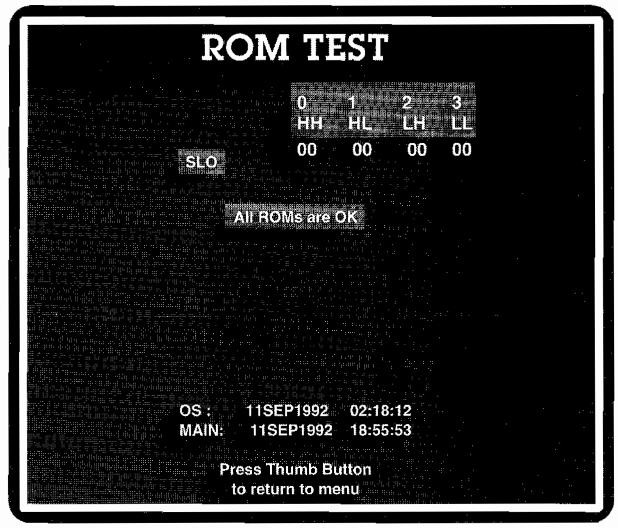


Figure 2-10 ROM Test Screen

If the test finds no ROM errors, no message appears and the program goes to the title screen in the attract mode. If a ROM fails, a message may be displayed. However, the program may be unable to show the location of the failed ROM. The ROM error message will stay on the screen for ten seconds.

If you think you have a ROM error, but the screen shows no messages, check the ROMs at 23E, 23J, 37E, and 37J on the Space Lords game PCB. Check these locations for bent pins or incorrectly inserted chips. Also see Table 3-2 for information about the locations of the ROMs and their functions.

Depending on how bad the ROM error is, you may not be able to enter the self-test.

Alphanumeric Test

The alphanumeric test, shown in Figure 2-11, checks the condition of the alphanumerics in the game. If you see an error in the alphanumerics or graphics on the screen, check the EPROM at 13N on the Space Lords game PCB. To page (scroll) the screen up and down, or to return to the select test menu, follow the instructions shown at the bottom of the screen.

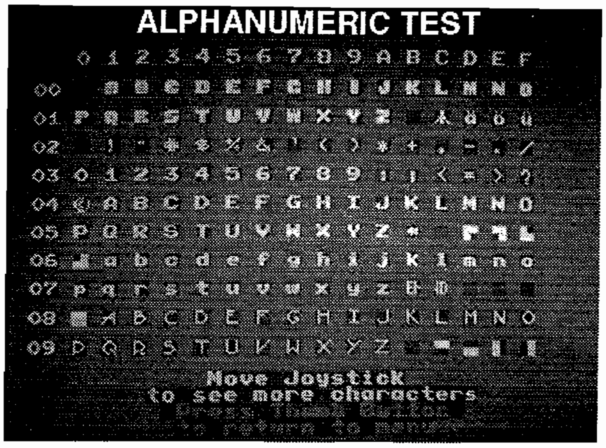


Figure 2-11 Alphanumeric Test Screen

Motion Object Tests

Motion Object Checksums

The first motion object test screen, shown in Figure 2-12, examines the checksums of the motion object ROMs. If the checksums match, *All Motion Object ROMs OK* is displayed. If the checksums do not match, either you have a defective EPROM/ROM or a chip may be installed incorrectly.

Motion Object Growth Test

The second motion object test screen shows two squares; one grows to full-screen size, while the other shrinks. Use the left joystick to control the rate of growth of these squares. Make sure the growth is smooth; any tearing of lines or pixels and/or inconsistent colors indicate a problem with the motion object circuitry.

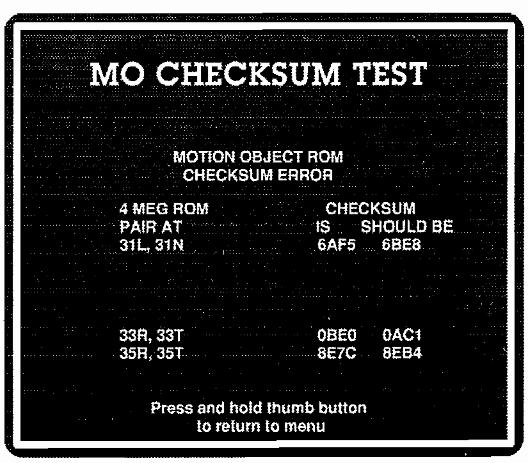


Figure 2-12 Motion Object Test Screen

Playfield Tests

The playfield test screen, shown in Figure 2-13, tests the movement of the playfield.

Scrolling Test

To scroll the playfield continuously in a horizontal or vertical direction, move the left joystick in the corresponding direction. Make sure that the playfield screen is clean and scrolls smoothly across the screen.

Stamp Test

To view the playfield stamps, move the joystick forward/backward.



Figure 2-13 Playfield Test Screen

Monitor Tests

This test has four screens. Advance to each screen to completely test the monitors.

Video Sync Test

NOTE

Do not run this test if a connected/linked game is not in Self-Test.

This test is useful for both linked and single Space Lords game cabinets. The video sync test (see Figure 2-14) checks that both games are synchronized. Make sure that *all* screens in your system are displaying this test; then check the positions of the four blocks on the screens. They should not drift from the correct posi-

tions, which are shown in Figure 2-14. All blocks should be close to the same height.

If the blocks on one screen are not in the same position as on the other screen or the blocks are drifting, you could have two causes for this problem. The CLARN II PCB could be bad, or the link harness or related connectors on it could be defective.

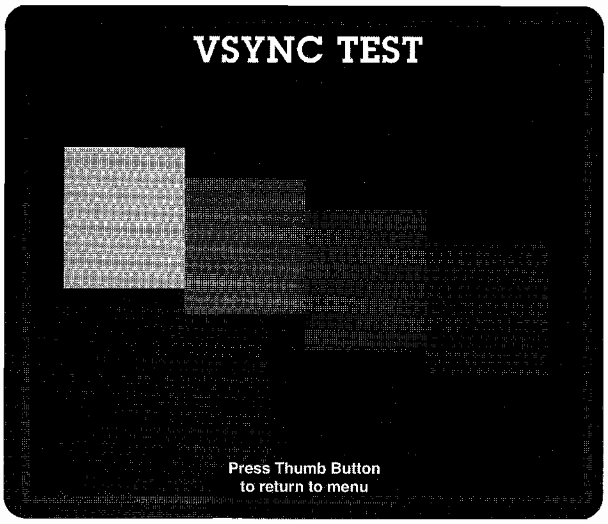


Figure 2-14 Video Sync Test

Color Test

The color test (see Figure 2-15) indicates the dynamic range of the video display color circuit. The screen should show three bands (red, green, and blue) plus white in the right half, ranging from black to white, from left to right. The red, green, and blue bands are produced by only one color gun being turned on in each band.

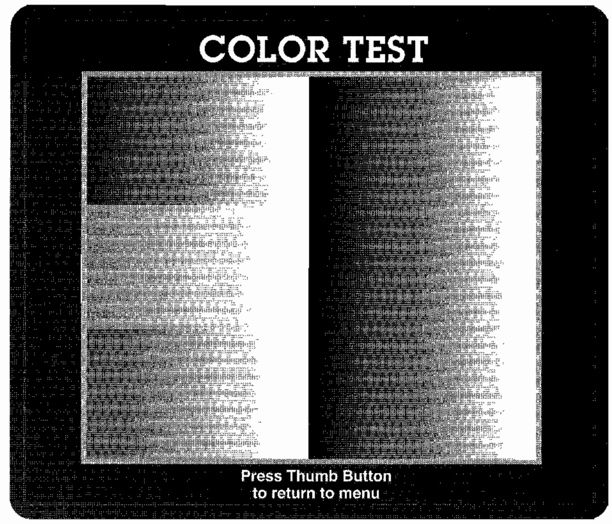


Figure 2-15 Color Test Screen

Purity Test

The next five screens are color purity tests. The entire screen will be red, green, blue, white, and grey. Press the trigger on the left joystick to change colors.

Each screen should show no unevenness of color and no lines in the display.

Convergence Test

The convergence test has three screens — white, violet, and green backgrounds with grid lines. The white screen is shown in Figure 2-16. To see the remaining screens, press the trigger button. Press the thumb button to go to the select test menu.

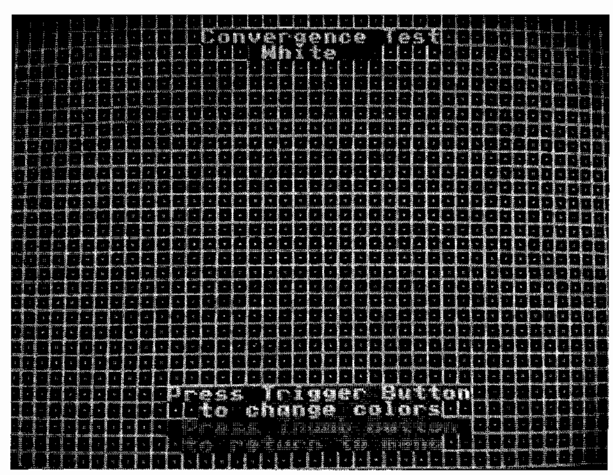


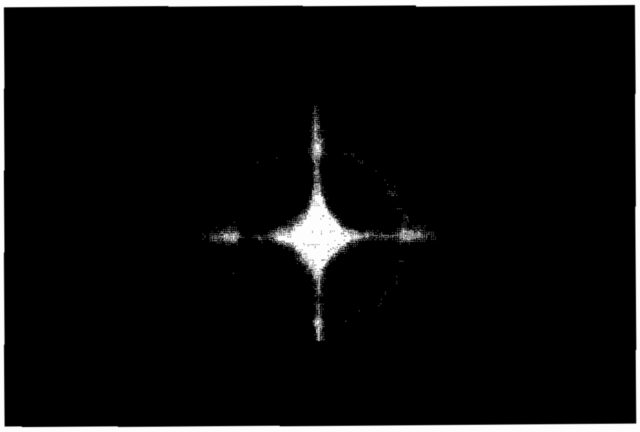
Figure 2-16 Convergence Test Screen

Check the following on the screens:

- The grid lines should be straight within 3.0 mm and the lines should not pincushion or barrel.
- The convergence of the lines on the violet and black screens should be within 2.0 mm.

If these screens do not meet these criteria, adjust the video display as described in the video display manual.

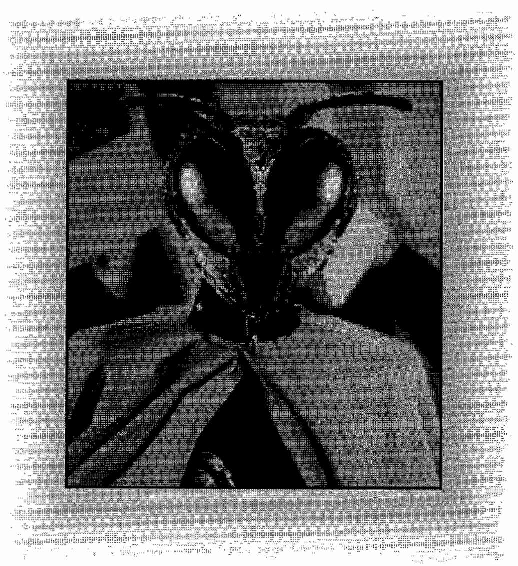
Return to the select test menu by pressing the thumb button.



Troubleshooting & Maintenance

Introduction

THIS CHAPTER contains maintenance, troubleshooting and repair procedures for your Space Lords™ game. The maintenance section gives information on cleaning the parts. The troubleshooting section contains several tables to help determine the source of a problem and the steps necessary to repair it. The repair section contains the steps necessary to remove and install the serviceable parts. Together, these three sections provide a complete guide to servicing your Space Lords™ game.



Problem	Suggested Action
Coin Mechanism Problem	1. Check the wiring connections to the coin mechanism. 2. Check the voltage to the + side of the mechanism. 3. Test the coin mechanism with the Sound Test screen in the self-test. 4. Check the power distribution board fuses.
Joystick or T-Handle Thruster Joystick Problem	1. Has the control been lubricated with the correct type of lubricant? If not, lubricate it as shown in Figures 4-2 and 4-6. 2. Check the harnesses and connectors. 3. Check the switches on the control. 4. If you took the control apart, have you reassembled it correctly? 5. Make sure all the parts of the control are in good repair. Repair or replace parts as needed. 6. Reset the limits on the joystick using the Controls Test in the self-test.
Pushbutton Switch Problem	1. Check the switch using the Controls Test in the self-test . 2. Check the wire connections and solder joints to the switch. 3. Check the switch for continuity using an ohmmeter. 4. Replace the switch only if it is bad.
Sound Problem	1. Check the speaker volume setting. 2. Check the voltage on the PCB edge connector. 3. Check the connections from the PCB to the speakers. 4. Check the voltage level to the PCB. 5. Check the sound ROMs in the Sound Board Test of the self-test procedure. 6. Check the resistance of the speakers for 8 Ohms. 7. Replace the speaker(s) only if bad.
Video Display Problem	
Screen is dark	1. Check to see that the game is plugged in. 2. Check to see that the game is turned on. 3. Check the line fuse. 4. Check the display brightness. 5. Check the solder connections on the line filter and the transformer. 6. Check the edge connector to the PCB. 7. Check the harnesses and connectors to the video display PCB. 8. Check the voltage levels to the video display PCB. 9. Run through the following checklist. If you answer *no* to any question, you have a problem with the video display, not with the game circuitry. In this case, refer to your video display service manual. a. Do you have power to the video display? b. Are the video display's filaments lit? c. Do you have the correct voltage to the video display?
Only a colored screen appears	1. Attempt to run a complete RAM/ROM test in the self-test. 2. Replace the RAM.
Display area wavers or is too small	1. Check the voltage levels to the video display PCB. 2. Check the B+ to the video display. (Refer to the video display manual.)
Strip light problem	1. Check the bulbs in the strip light. 2. Check the Power Distribution Board fuses. 3. Test the strip lights in the self-test.

Table 3-1 General Troubleshooting

Problem	Suggested Action
Picture is wavy	1. Check the connection of the monitor ground wire to the monitor. 2. Check the connections of the sync inputs.
Picture is upside down or reversed	1. Switch the horizontal or vertical yoke wire connections to the video display.
Convergence, purity or color problems	1. Use the self-test mode to digitally adjust the video display. 2. Use the adjustment procedures in your video display manual.
Picture is not centered	1. Use the centering procedures in your video display manual.
Electronic Game Link Problem	1. Check the harnesses and connections between both games.

Table 3-1 General Troubleshooting, Continued

Maintenance Procedures

Introduction

This section describes the maintenance procedures for all of the major assemblies and components of the game. The maintenance procedures should be performed every 3–4 months on a regular basis.

WARNING

Before performing any maintenance or repairs, please observe all of the following safety precautions:

1. *Turn the game's power off.*
2. *Unplug the power cord from the electrical socket.*
3. *Secure loose clothing such as ties and long sleeves that could get caught within the game.*
4. *Remove all metal jewelry such as watches and necklaces that could conduct electricity from the game's power sources.*

Cleaning Procedure for Coin Mechanisms

Regular use of the coin mechanisms may result in a build-up of residue and dirt. If this is the case, clean the coin mechanism by following the steps below (refer to Figure 4-5 and Figure 4-6 for detailed part information on the coin door).

1. Open the upper coin door.
2. Open the gate on the door that covers the magnet. Use the blade of a screwdriver to scrape away any metal filings that have collected on the magnet.
3. Clean the loose dust and dirt from the coin mechanism with a lint-free rag or a soft brush.
4. Clean the dirt and residue from the coin path with a toothbrush. Hot, soapy water may be used to help dissolve dirt and residue.
5. Blow out all the loose dirt and dry the coin mechanism with compressed air.
6. Close the gate on the door that covers the magnet and close the upper coin door.

CAUTION

Never lubricate the coin mechanism with oil or grease.

Troubleshooting Procedures

This section is designed to help determine the source of a malfunction and detailed information on repairing the problem.

Table 3-1 General Troubleshooting, is divided into two columns. The left-hand column is broken down into the general nature of problems. The right-hand column lists suggested solutions to solve the problem.

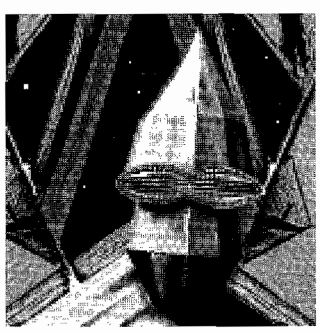
Table 3-2 ROMs and RAMs Troubleshooting, is designed to help determine the specific ROMs and RAMs that are the source of a game logic malfunction. The left-hand column shows some problems that may result from malfunctioning ROMs and RAMs. The middle column shows the ROMs and RAMs that may be the source of the problem and their purposes. The right-hand column shows the PCB locations of the ROMs and RAMs that may be causing the problem.

Table 3-3 Voltage Inputs and Test Points, is divided into three columns. The left-hand column shows the correct voltages that should be measured. The middle column shows the physical locations of the test points or LEDs. The right-hand column shows the sources and purposes of the voltages.

Repair Procedures

Introduction

This section describes the repair procedures for all of the major assemblies and components of the game. Before performing any repairs, use the tables in the *Troubleshooting Procedures* section to help narrow the source of the problem. The *Maintenance Procedures* section may also provide a good starting point for fixing many game problems before beginning what might be unnecessary repairs.



Speakers

Each game has two speakers, one for each side. The speakers provide the music and sounds for the game and self-tests. Failure of the speakers may result in distorted or no sound. If this is the case, replace the speakers by following the removal and installation steps below.

1. Remove the attraction shield and decal by removing the retainers that secure them.
2. Disconnect the harness to the speaker.
3. Remove the four screws and washers securing the speaker housing.
4. Disconnect the harness from the speaker; then remove the four screws securing the speaker.
5. Replace and reinstall the harness speaker.

Strip Lights

To replace the strip light bulbs, follow the removal and installation steps below.

1. Remove the plastic attraction panel at the top of the game cabinet by removing the retainers that secure it.
2. Unfasten the screws that retain the strip light brackets on top of the cabinet.
3. Lift the strip light bracket out of the slot on top of the cabinet and disconnect the harness to the PCB assembly.
4. Rotate the bulb 1/4 turn (90 degrees) in the lamp clips and remove it by pulling on the bulb.

Thruster Joysticks

To replace the microswitch on either T-handle thruster joystick, disconnect the wires to the switch on the joystick (see Figure 4-6). Remove the screws that hold the switch on the joystick. Remove the switch.

Pot Joysticks

The pot joystick and its handle are shown in Figure 4-2. If you want to repair the joystick control, disassemble it by removing it from the control panel. The hardware that secures the joystick assembly to the control is listed in Figure 4-4.

System Logic Assemblies

This section describes the repair and maintenance procedures for the major assemblies and components that are related to the system's logic and electronics, including the printed-circuit boards (PCBs) and the power supply. These components are housed in the bottom of the cabinet below the video display.

Space Lords Game PCB Set

The Space Lords game PCB set is responsible for the display graphics and game play. Failure of the game PCB set may result in erratic or no game play. If this is the case, repair or replace the game PCB set by following the removal and installation steps below.

1. Unlock the right rear access panel of the cabinet (as you view it from the rear) and remove it.
2. Disconnect the harness connectors from the game PCB set.
3. Unfasten the screw and spacer that secures the game PCB set to the cabinet. Remove the game PCB set and its attached cover (refer to Figure 4-7).

CAUTION

Before handling static-sensitive components, properly ground yourself to discharge buildup of static charges.

4. Re-install the game PCB set by following the previous steps in the reverse order.

Electronic Game Link

Each Space Lords game is linked internally. Electronic game link connector are available to electronically link two Space Lords game cabinets together for up to eight-person play. Damage to the electronic game link connector may cause the eight-person play to function incorrectly or not at all. If this is the case, replace the electronic game link connector by following the removal and installation steps below.

1. Unlock the rear access panel of the cabinet and remove it.
2. Disconnect the external game link cable from the game link connector.
3. Remove the ground plane hat and disconnect the link connector from the CLARN II PCB.
4. Unfasten the 4 screws that secure the game link plate to the cabinet and remove the game link connector and attached plate.
5. Install the new game link connector by following the previous steps in the reverse order.

Power Supply

The power supply is responsible for providing power to all of the game assemblies that require it. Failure of the power supply may result in erratic game play or no power at all. If this is the case, repair or replace the power supply assembly by following the steps below.

1. Unlock the rear access panel of the cabinet and remove it.
2. Disconnect the wiring harnesses from the power supply.

WARNING

The power supply can contain high voltages even after the power is turned off. To avoid injury, observe all of the safety precautions before working on the power supply. (Refer to the Introduction in the Maintenance Procedures section.)

3. Unfasten the 4 screws that secure the power supply assembly to the cabinet, and remove the power supply assembly.
4. Re-install the power supply assembly by following the previous steps in the reverse order.

ROMs/RAMs

The ROMs and RAMs contain the programming routines used by the game PCB set to control game play. Refer to *Table 3–2 ROMs and RAMs Troubleshooting* to determine the ROMs or RAMs that are malfunctioning. Replace the damaged ROMs or RAMs by following the removal and installation steps below.

1. Remove the game PCB set according to the procedure in the *Space Lords Game PCB Set* section.

CAUTION

Before handling static-sensitive components, properly ground yourself to discharge buildup of static charges.

2. Remove the damaged ROMs and RAMs from the game PCB set using a chip extraction tool.
3. Install the new ROMs and RAMs by plugging them in the game PCB set sockets.
4. Re-install the game PCB set by following the steps in the *Space Lords Game PCB Set* section in the reverse order.

Video Display

To repair, replace or make adjustments to the video display, follow the removal and installation steps below.

Problem	ROMs/RAMs Source and Purpose	Location
ROMs		
The program works, but the motion objects are incorrect or non-existent.	Motion Object ROMs (responsible for moving graphic objects)	31L, 31N, 31R, 31T, 33L, 33N, 33R, 33T, 35L, 35N, 37L, 37N
Garbage appears on the screen or game play doesn't work correctly.	Program ROMs (responsible for game control)	23E, 23J, 37E, 37J
The text or numbers are incorrect or non-existent.	Alphanumeric ROM (responsible for controlling graphic text and numbers)	13N
The sound is incorrect or non-existent.	Audio ROMs (responsible for controlling sound)	
	Audio Program ROM	18E
	Audio ADPCM ROM	5A
The moving backgrounds graphics are incorrect or non-existent.	Playfield ROMs (responsible for controlling background graphics)	2D, 5D
RAMs		
The display color is yellow.	Working RAM	
The display color is green.	Video RAM	
The display color is white.	Color RAM	

Table 3-2 ROMs and RAMs Troubleshooting

Voltage	Test Point or LED Location	Voltage Source and Purpose
+5 ± 0.25 VDC	+5V1	Logic power from the switching power supply.
	CR1 LED (GX2 or game PCB)	Lights when 5 V is applied to the PCB and the reset (RST) jumper is open.
	CR1 LED (JSA3S PCB)	Lights when the +12 V supply is good.
	CR2 LED (JSA3S PCB)	Lights should be out (connected to ground)
	CR1 LED (CLARN II PCB)	Lights when left GX2 is powering CLARN II +5V
	CR2 LED (CLARN II PCB)	Lights when right GX2 is powering CLARN II +5V
	CR3 LED (CLARN II PCB)	Blinks to indicate which CLARN II is video sync master.
+12 V	+VOP (pin 4 of LM324)	+12 V from the switching power supply. Positive supply for the analog circuitry.
–5 V	–VOP (pin 11 of LM324)	–5 V from the switching power supply (if connected). Negative supply for the analog circuitry (connected to ground).

Table 3-3 Voltage Inputs and Test Points

WARNING

High Voltage

The video display contains lethal high voltages. To avoid injury, do not service this display until you observe all precautions necessary for working on high-voltage equipment.

X-Radiation

This video display is designed to minimize X-radiation. However, to avoid possible exposure to soft X-radiation, never modify the high-voltage circuitry.

Implosion Hazard

The cathode-ray tube (CRT) may implode if struck or dropped. The shattered glass from the tube may cause injury up to six feet away. Use care when handling the display and when removing it from the game cabinet. Also, wear gloves to protect your hands from the sheet-metal edges.

1. Unfasten the 8 square drive screws that secure the monitor doors to the cabinet and remove them.
2. Discharge the high-voltage from the cathode-ray tube (CRT).

NOTE

The label on the video display assembly shows a circuit for discharging the high-voltage contained in the CRT to ground when the power is off.

   a. Secure one end of a solid 18-gauge wire to a well-insulated or wooden handle screwdriver.
   b. Secure the other end of the wire to an earth ground.
   c. Briefly touch the blade end of the screwdriver to the CRT anode by sliding it under the anode cap.
   d. Wait 2 minutes and repeat the previous step.
3. Disconnect all of the wire harnesses from the video display.
4. Unfasten the 13 square drive screws that secure the light housing assembly and remove it.
5. Unfasten the 10 square drive screws that secure the lower glass retainers. Remove the display shields and card-board bezels.
6. Unfasten the 4 flat washers and nuts that secure each video display chassis to the cabinet monitor mounting brackets.
7. Remove the video display assembly from the cabinet.

NOTE

Do not attempt to remove the video display without its chassis.

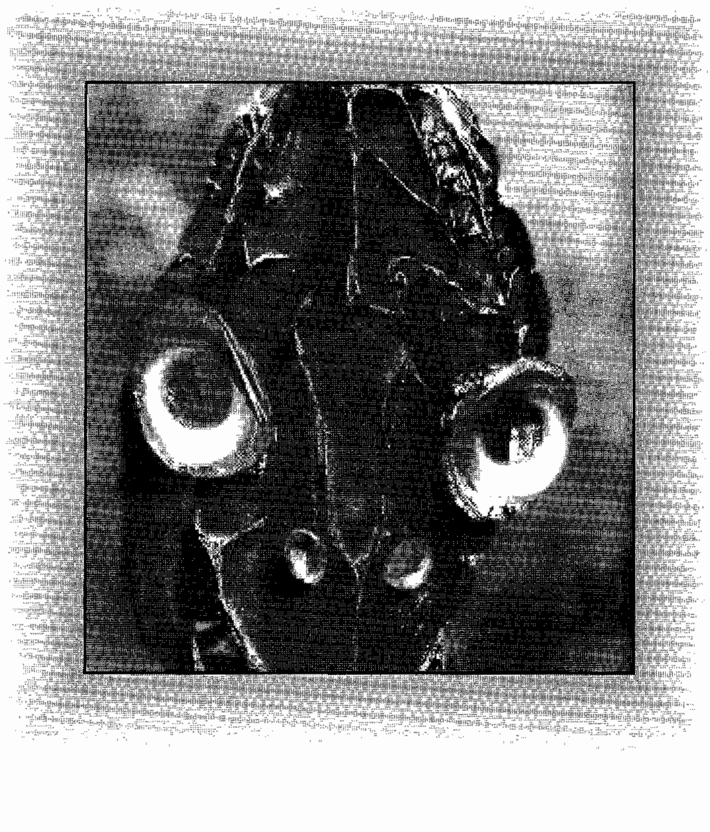
8. Install the new video display by following the previous steps (excluding steps 2a.–2d.) in the reverse order.
9. If necessary, adjust the new video display's brightness, size, centering, purity and convergence according to the video display service manual.

NOTES

Parts Illustrations

Part Ordering Information

THIS CHAPTER provides information you need to order parts for your game. The printed-circuit board (PCB) parts lists are arranged in alphabetical order by component. Within each section the parts are arranged numerically by part number. When you order parts, give the part number, part name, the number of this manual, and the serial number of your game. With this information, we can fill your order rapidly and correctly. We hope this will create less downtime and more profit from your games. Atari Games Customer Service phone numbers are listed on the inside front cover of this manual.



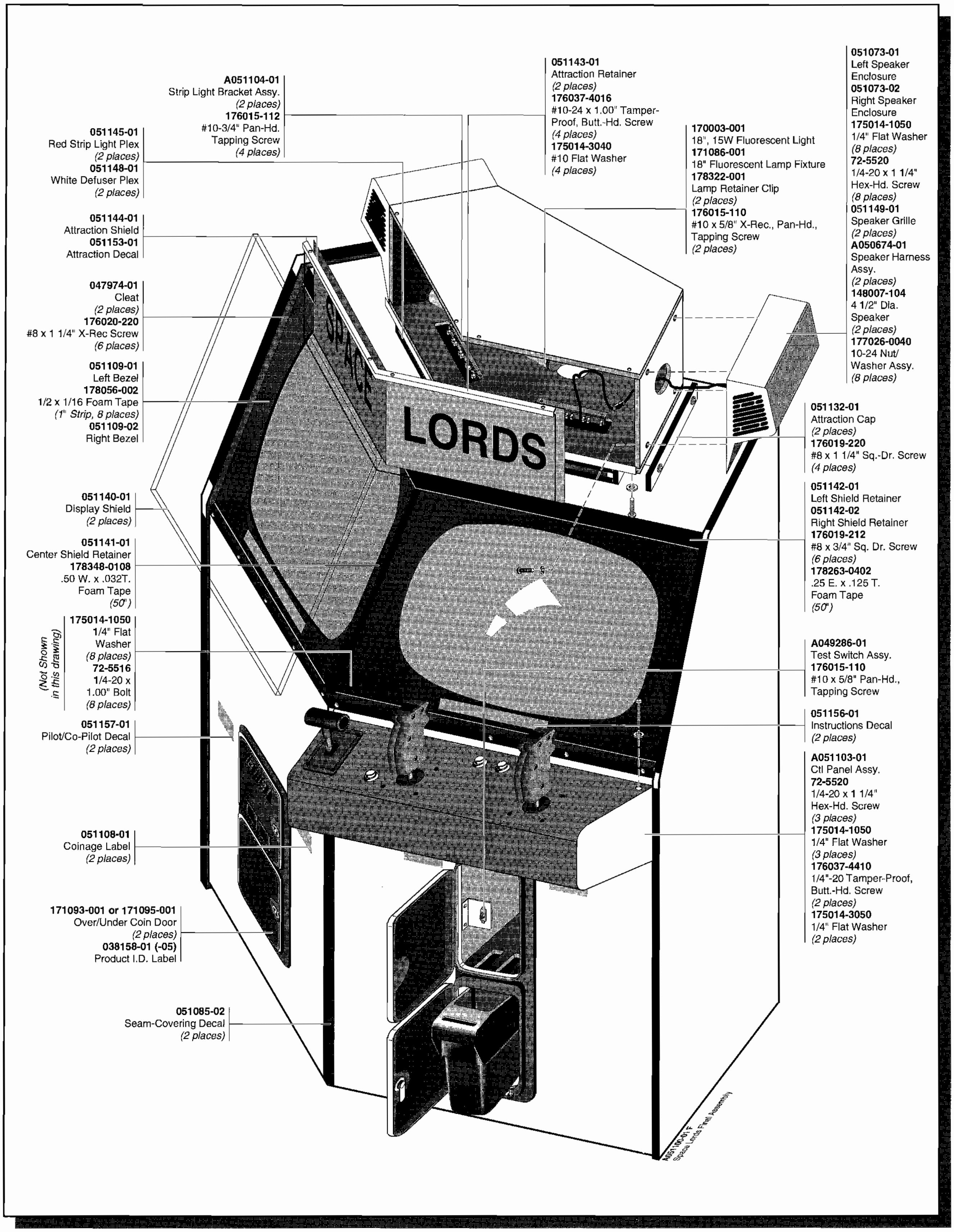


Figure 4-1 Cabinet-Mounted Assemblies, Front View

A051100-01 F

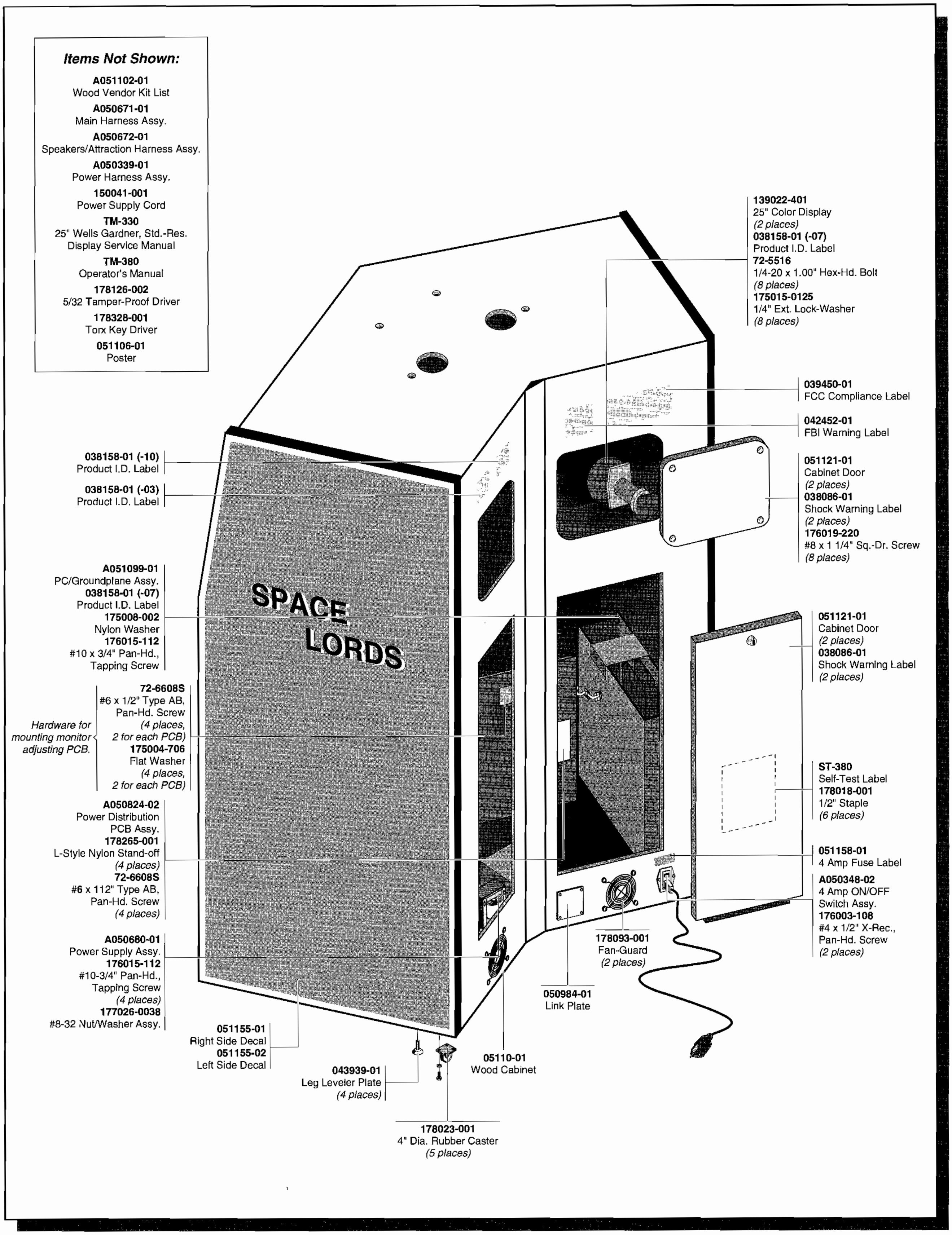


Figure 4-1 Cabinet-Mounted Assemblies, Rear View

A051100-01 F

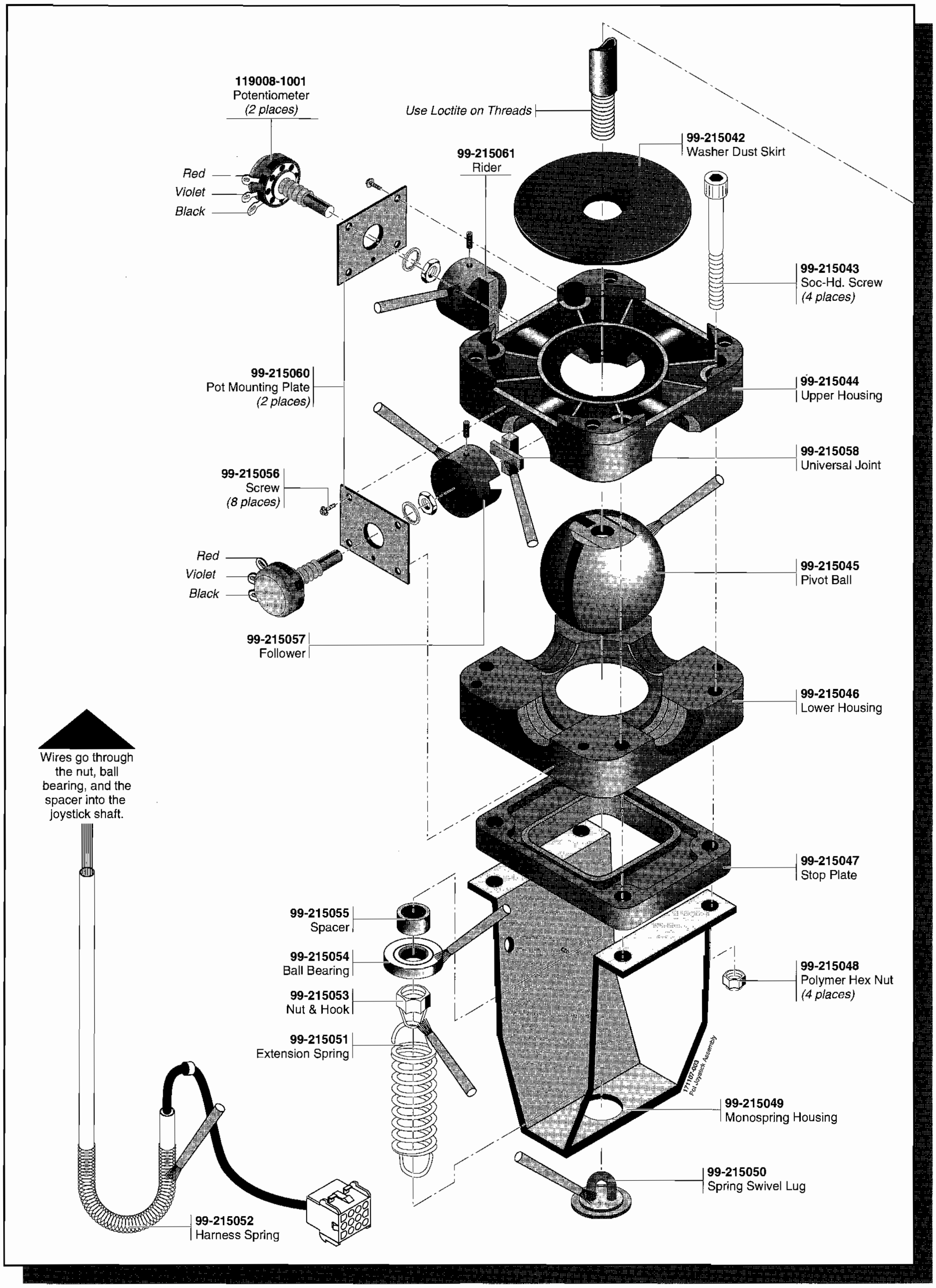


Figure 4-2 Pot Joystick Assembly

171107-001

NOTE

A small number of Space Lords games initially produced used an alternate pot joystick assembly — part no. A050136-01. That assembly is illustrated in the supplement to this manual, CO-380-02.

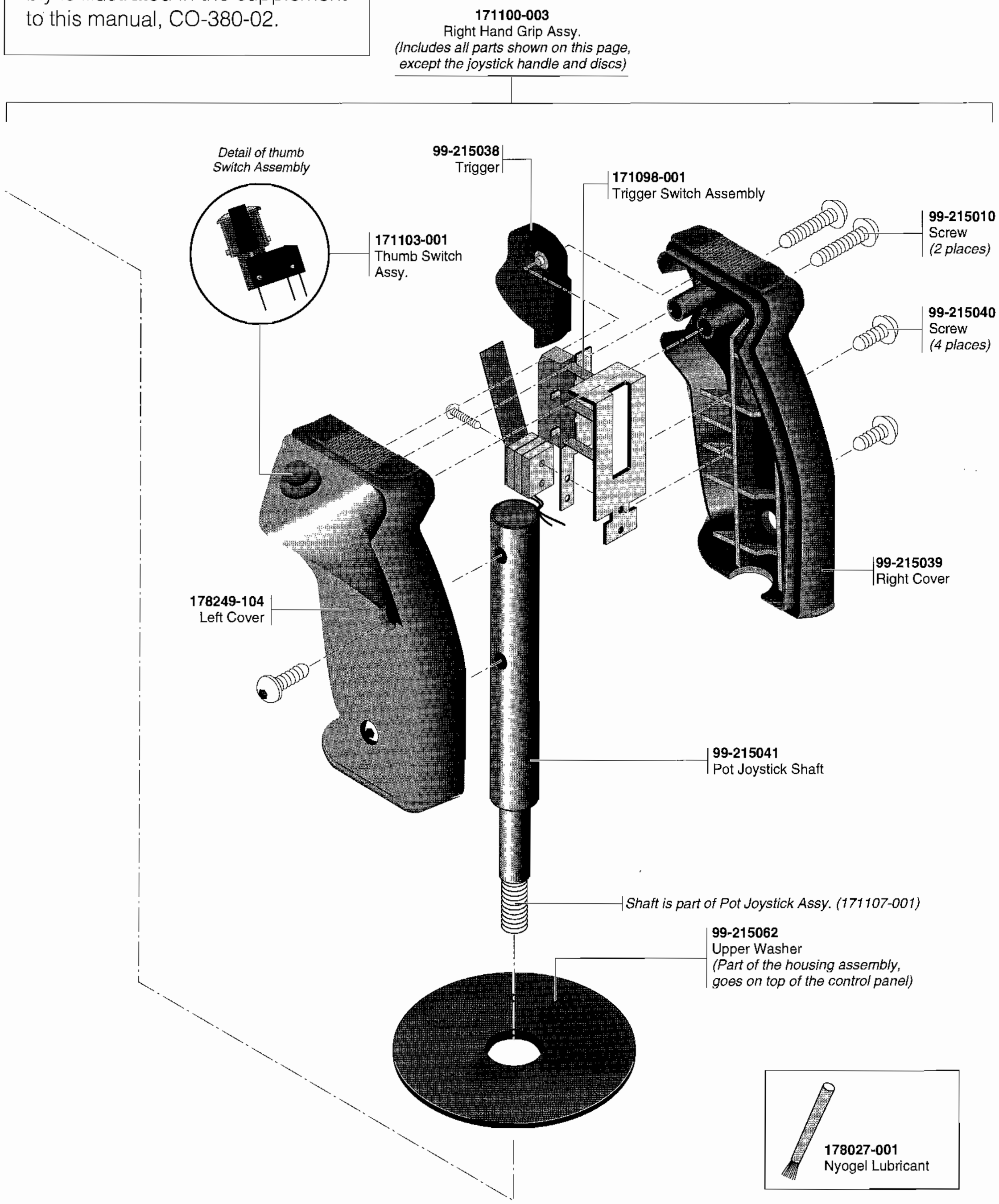


Figure 4-2 Pot Joystick Assembly

171107-001

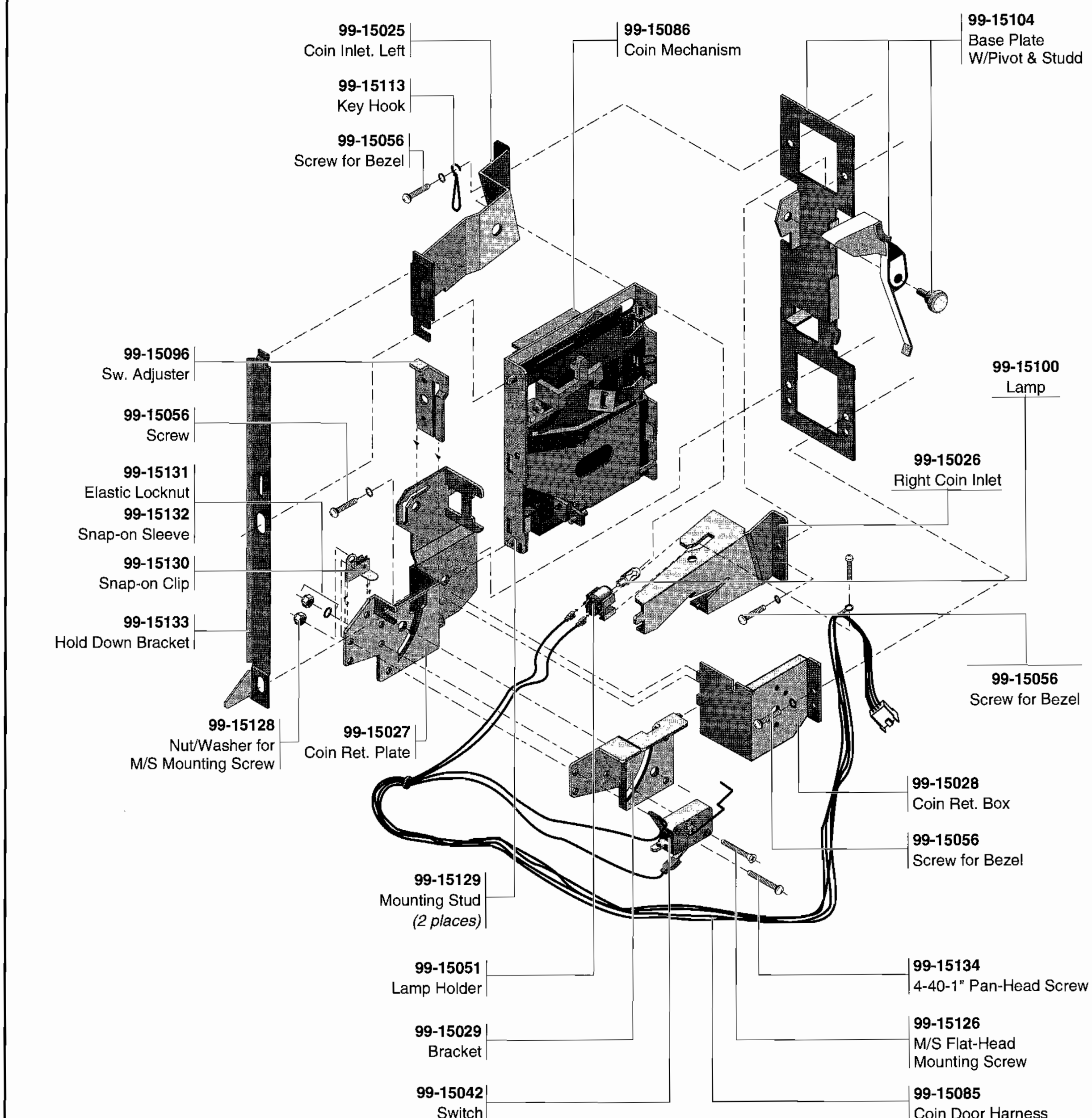


Figure 4-3 Over/Under Coin Door and Cash Box

171093-001 (171095-001 is an acceptable substitute)

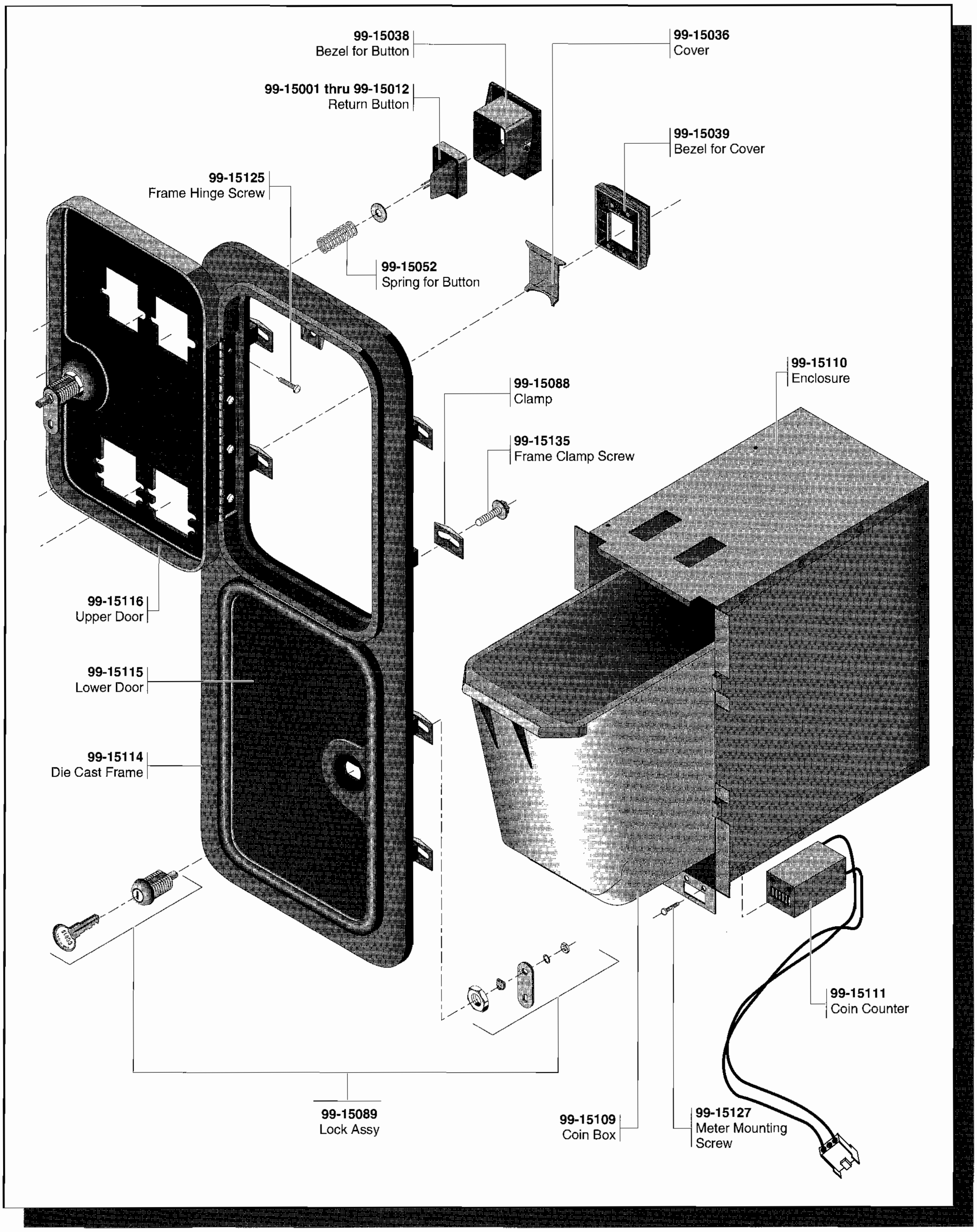


Figure 4-3 Over/Under Coin Door and Cash Box

171093-001 (171095-001 is an acceptable substitute)

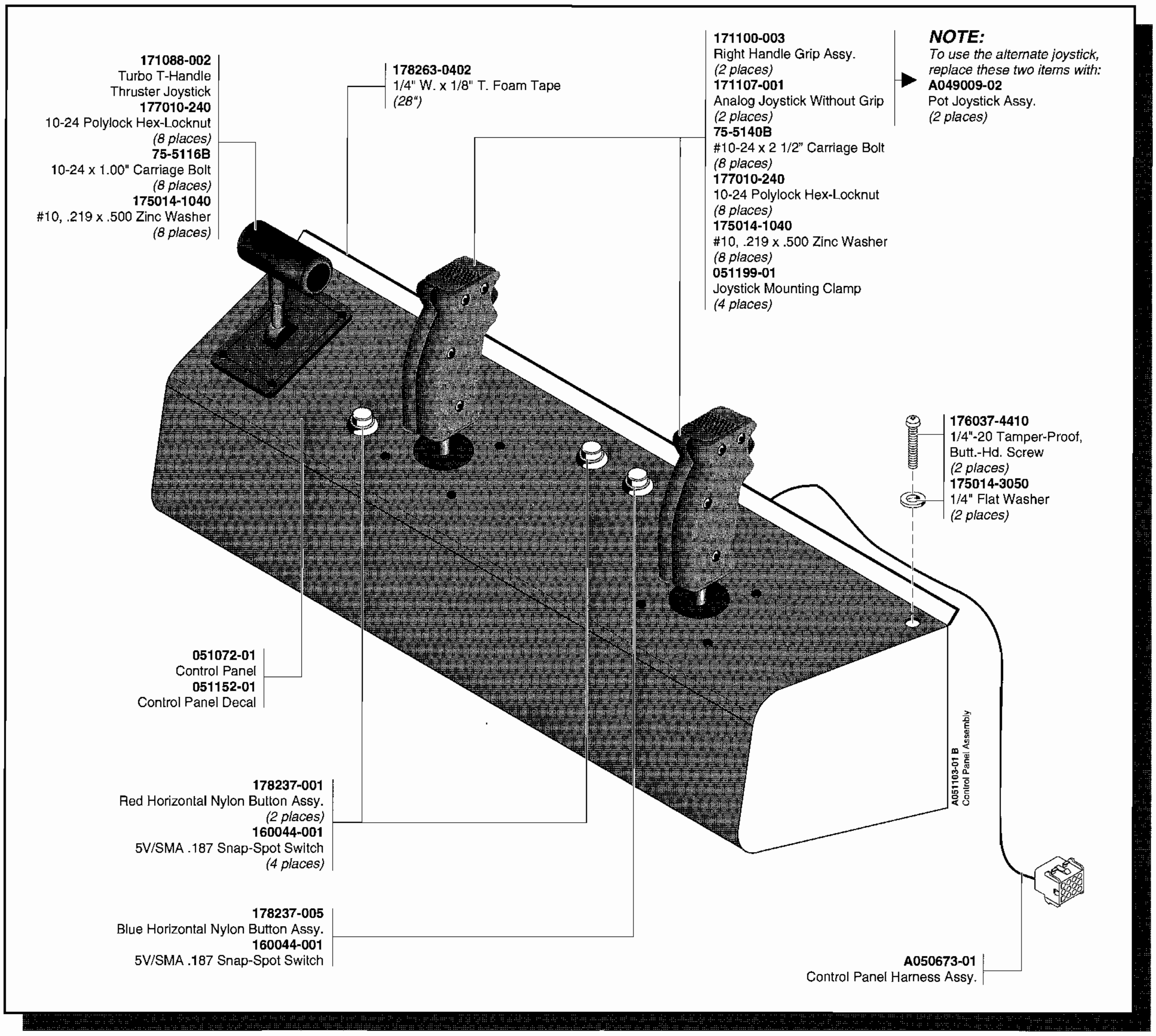


Figure 4-4 Control Panel Assembly

A051103-01 B

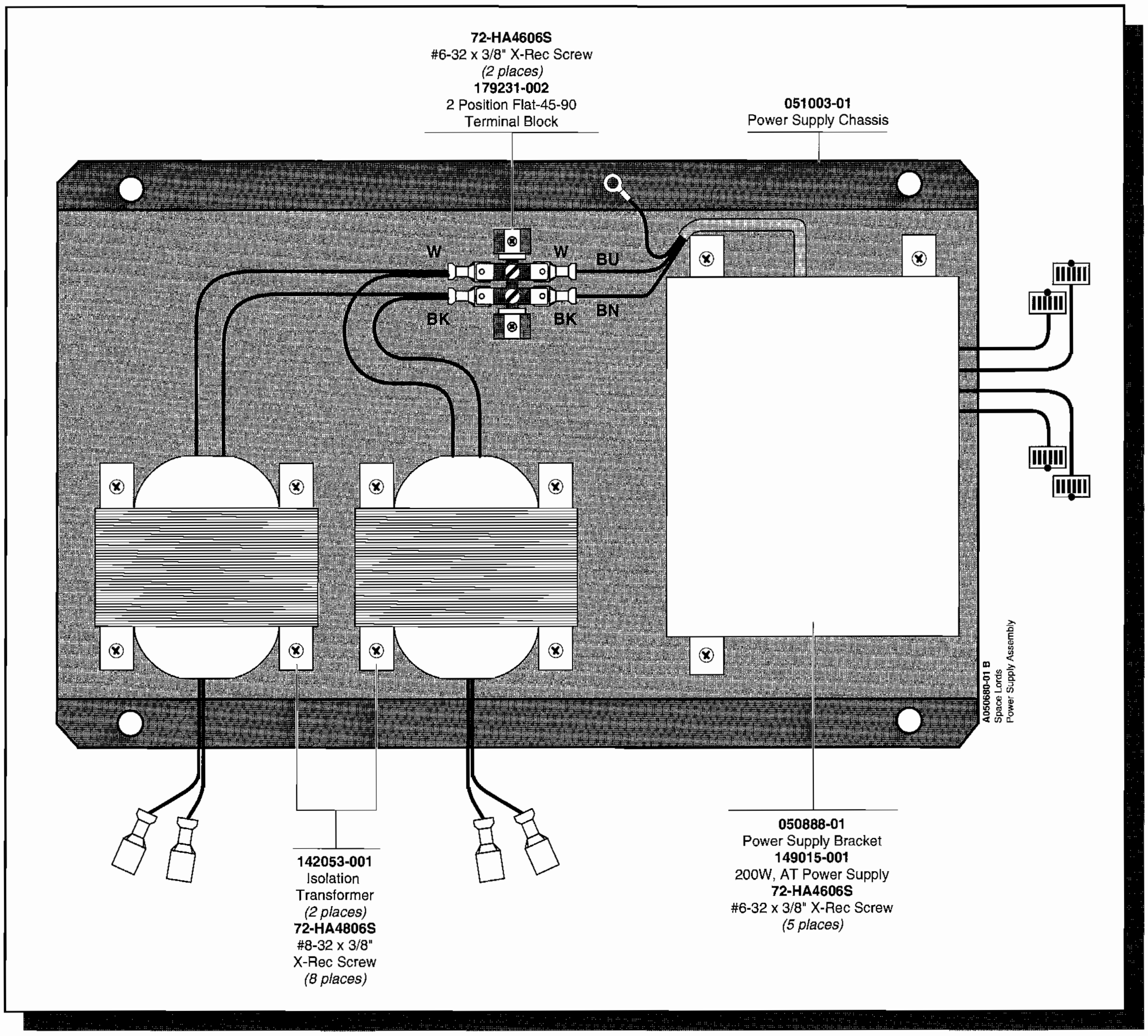


Figure 4-5 Power Supply Assembly

A050680-01 B

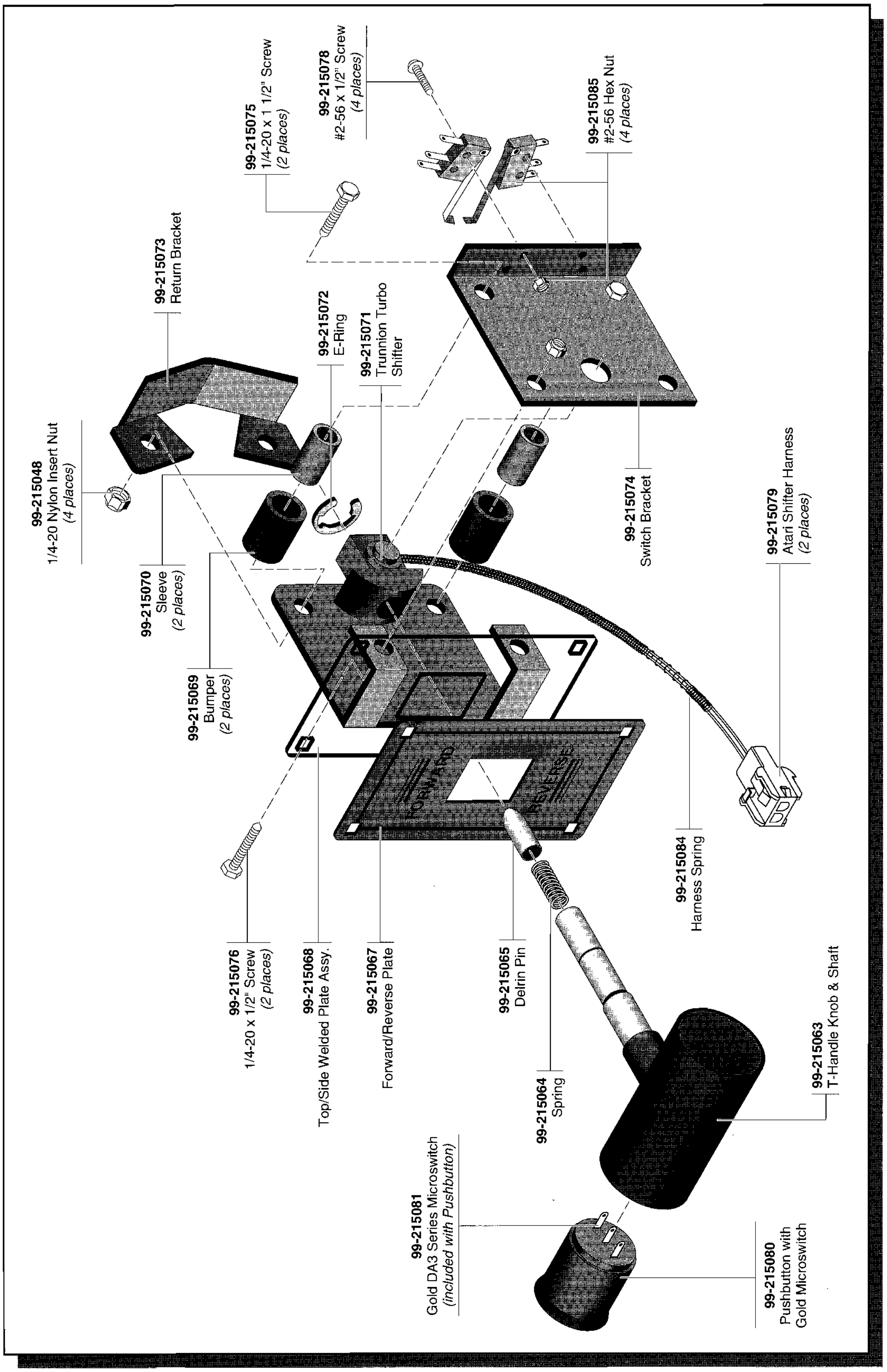


Figure 4-6 Turbo T-Handle Thruster Joystick Assembly

171088-002

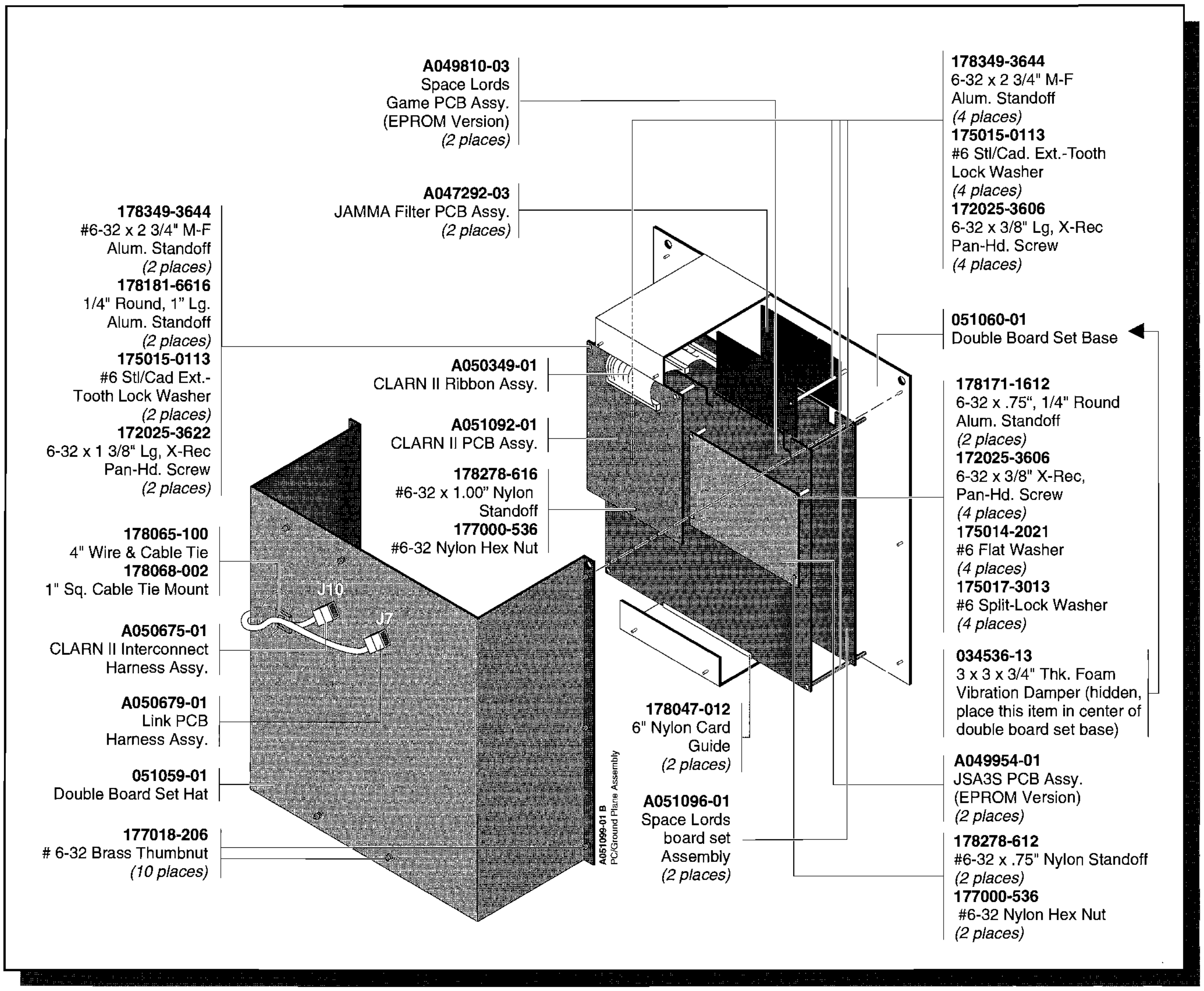


Figure 4-7 Space Lords PC/Ground Plane Assembly

A051099-01 B

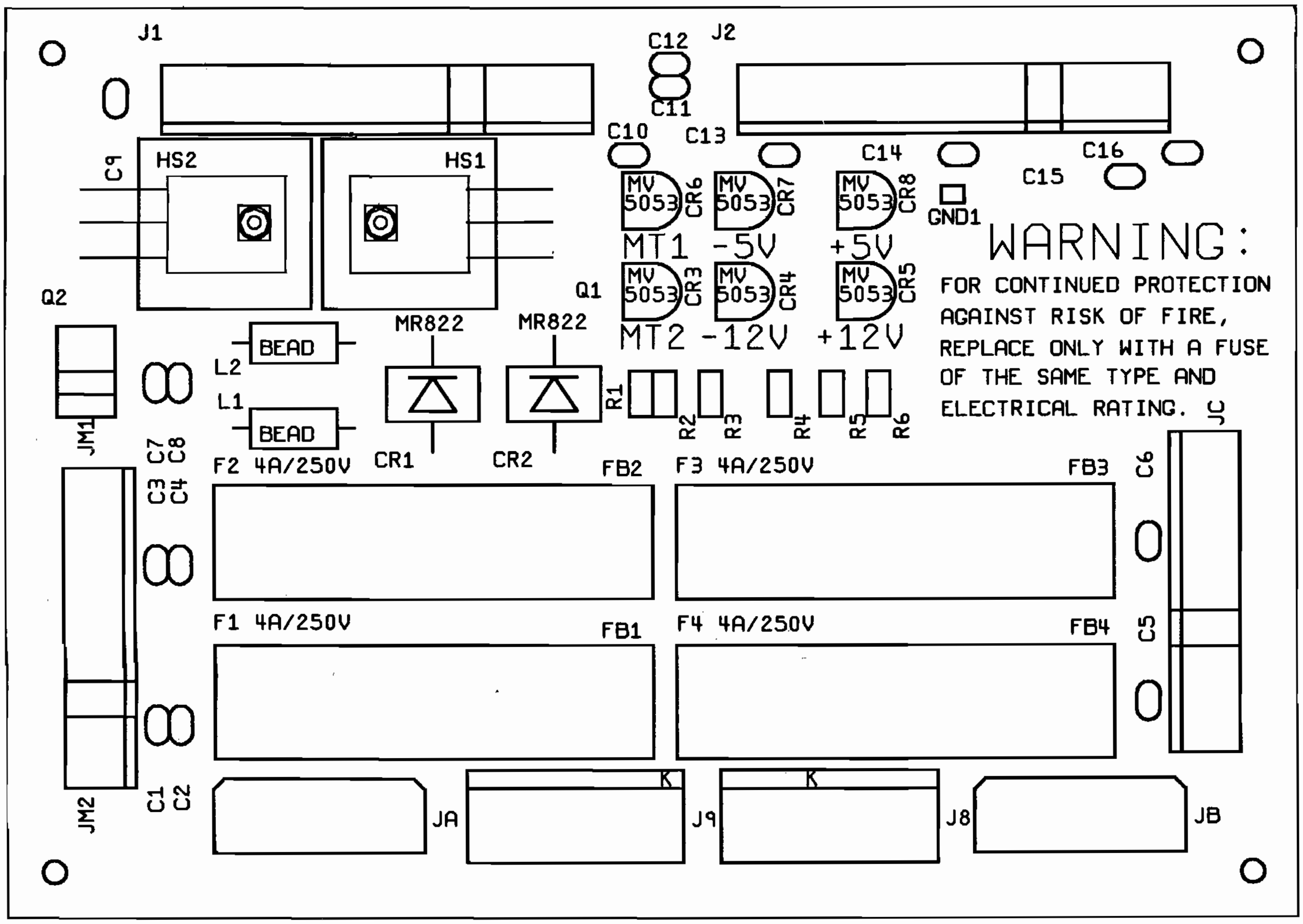


Figure 4-8 Power Distribution PCB Assembly

A050824-01 B

Power Distribution PCB Assembly
Parts List

Designator	Description	Part No.
C1–6,C9–C16	.01 µF, 50V, +80% –20% Cer. Cap.	122002-103
C7–8	100 pF, 100V, ±5% Cer. Cap.	122016-101
J1, J2	Hdr. Connector, 12 Ckt., .156 Ctr, Key 9	179213-012
JM1	Hdr. Connector, 4 Ckt., .100 Ctr, Key 2	179118-004
JA, JB	Hdr. Connector, 4 Ckt., .200 Ctr	179310-004
J8, J9	Hdr. Connector, 6 Ckt., .156 Ctr	179309-006
JM2	Hdr. Connector, 9 Ckt., .156 Ctr, Key 3	179213-009
JC	Hdr. Connector, 9 Ckt., .156 Ctr, Key 6	179213-009
CR1, CR2	MR822 Diode	131019-001
CR3–CR8	MV5053 Light-Emitting Diode	131027-002
FB1–FB4	3AG Fuse Block	179225-4401
L1, L2	N12N Ferrite Bead Inductor	141003-005
R1, R2, R4, R6	Resistor, 1.2 K Ω, ±5%, 1/8 W	110027-122
R3, R5	Resistor, 470 Ω, ±5%, 1/8 W	110027-471
GND1	Test Point	179051-001
Q1, Q2	BUZ11 Transistor	133054-001
HS1, HS2	TO-220 Heat Sink with #4-40 Stud	178063-007
F1–F4	3AG 4 Amp 250 V Slow-Blow Fuse	146008-4022
(HS1, HS2)	#4-40 Steel/Zinc Hex Nut	177000-132
(HS1, HS2)	#4 Steel/Zinc Internal-Tooth Washer	75-054
(HS1, HS2)	#4 Steel/Zinc Rect. Washer	178347-001

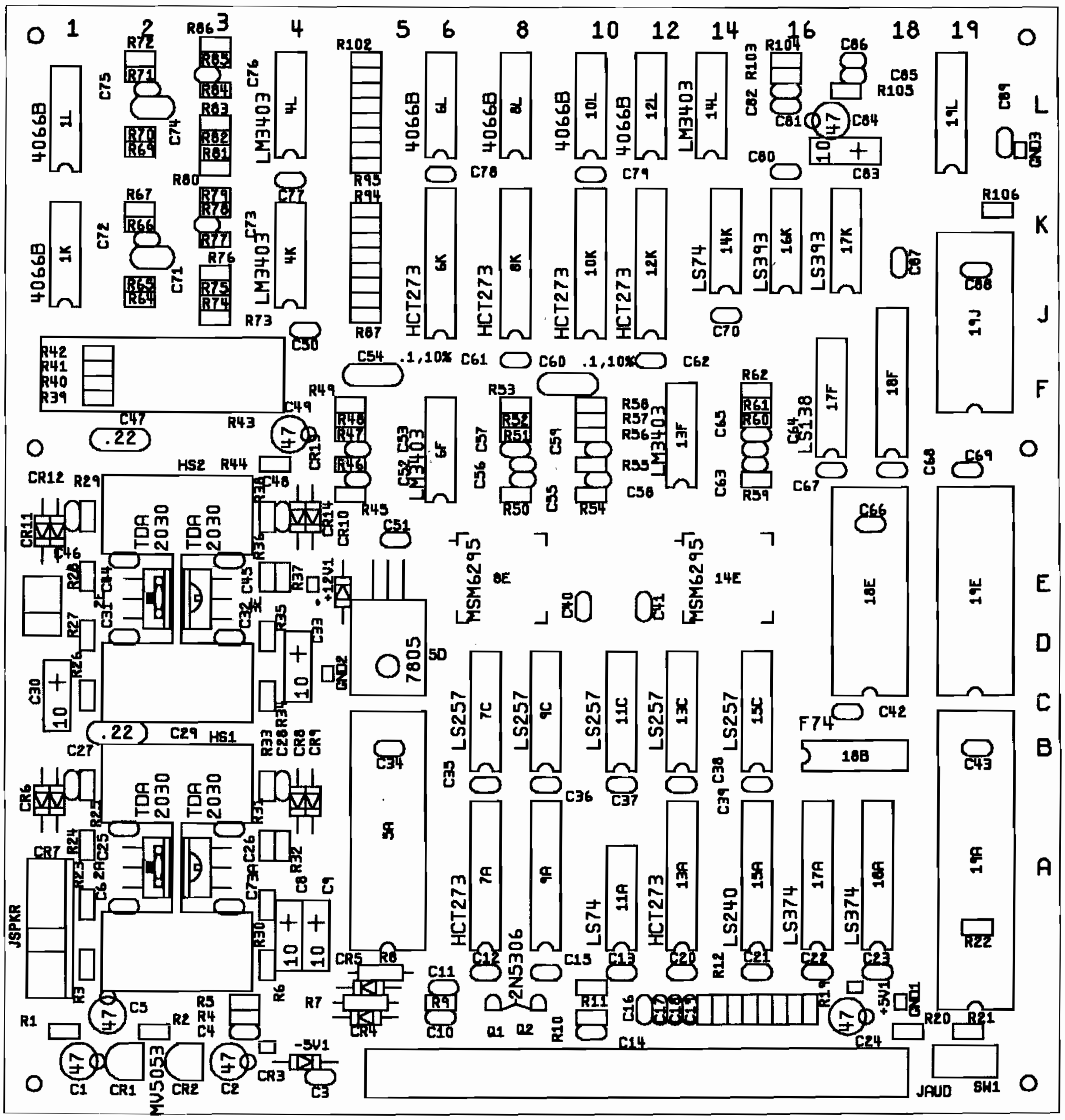


Figure 4-9 JSA3S PCB Assembly (EPROM Version)

A049953-XX A

JSA3S PCB Assembly (EPROM Version)
Parts List

Designator	Description	Part No.
	Socket, 16 Pin, .300	179259-016
	Socket, 20 Pin, .300	179259-020
	Socket, 24 Pin, .600	179257-024
	Socket, 28 Pin, .600	179257-028
	Socket, 32 Pin, .600	179257-032
	Socket, 40 Pin, .600	179257-040
1K, 1L	IC, 4066B	137580-001
2A,2E,3A,3E	IC, TDA2030	137301-001
4K, 4L	IC, Quad Op-Amp, LM3403	137673-001
5A	EPROM, 512KX8, 100 ns	136095-0081
5D	IC, 7805	137596-001
6F	IC, Quad Op-Amp, LM3403	137673-001
6K	IC, 74HCT273	137655-001
6L	IC, 4066B	137580-001
7A	IC, 74HCT273	137655-001
7C	IC, 74LS257	137136-001
8E	IC, MSM6295	137607-001
8K	IC, 74HCT273	137655-001
8L	IC, 4066B	137580-001
9C	IC, 74LS257	137136-001
10K	IC, 74HCT273	137655-001
10L	IC, 4066B	137580-001
11A	IC, 74LS74	137023-001
11C	IC, 74LS257	137136-001
12K	IC, 74HCT273	137655-001
12L	IC, 4066B	137580-001
13A	IC, 74HCT273	137655-001
13C	IC, 74LS257	137136-001
13F	IC, Quad Op-Amp, LM3403	137673-001
14E	IC, MSM6295	137607-001
14K	IC, 74LS74	137023-001
14L	IC, Quad Op-Amp, LM3403	137673-001
15A	IC, 74LS240	137251-001
15C	IC, 74LS257	137136-001
16K	IC, 74LS393	137146-001
17A	IC, 74LS374	137144-001
17F	IC, 74LS138	137177-001
17K	IC, 74LS393	137146-001
18A	IC, 74LS374	137144-001
18B	IC, 74F74	137436-001
18E	EPROM, 64KX8, 200 ns	136095-0080
18F	GAL16V8, 25 ns	136095-0082
19A	IC, 6502 A	137577-001

Designator	Description	Part No.
19E	IC, RAM, 8KX8, 100 ns, .6	137535-004
19J	IC, YM2151	137401-001
19L	IC, YM3012	137402-001
C1, C2	Capacitor, 47 µF, 50 V, Electrolytic	123015-476
C3, C4	Capacitor, .1 µF, 50 V, +80%–20%, Cer.	122002-104
C5	Capacitor, 47 µF, 50 V, Electrolytic	123015-476
C6, C7	Capacitor, .1 µF, 50 V, +80%–20%, Cer.	122002-104
C8, C9	Capacitor, 10 µF, 25 V, Electrolytic	124009-106
C12–C23	Capacitor, .1 µF, 50 V, +80%–20%, Cer.	122002-104
C24	Capacitor, 47 µF, 50 V, Electrolytic	123015-476
C25–C28	Capacitor, .1 µF, 50 V, +80%–20%, Cer.	122002-104
C29	Capacitor, .22 µF, 50 V, ±10%, Cer.	122015-224
C30	Capacitor, 10 µF, 25 V, Electrolytic	124009-106
C31, C32	Capacitor, .1 µF, 50 V, +80%–20%, Cer.	122002-104
C33	Capacitor, 10 µF, 25 V, Electrolytic	124009-106
C34–C46	Capacitor, .1 µF, 50 V, +80%–20%, Cer.	122002-104
C47	Capacitor, .22 µF, 50 V, ±10%, Cer.	122015-224
C48	Capacitor, .1 µF, 50 V, +80%–20%, Cer.	122002-104
C49	Capacitor, 47 µF, 50 V, Electrolytic	123015-476
C50, C51	Capacitor, .1 µF, 50 V, +80%–20%, Cer.	122002-104
C52, C53	Capacitor, 6800 pF, 50 V, ±10%, Cer.	122015-682
C54	Capacitor, .1 µF, 50 V, ±10%, Cer.	122015-104
C55	Capacitor, 1000 pF, 100 V, ±10%, Cer.	122015-102
C56	Capacitor, 3900 pF, 50 V, ±10%, Cer.	122015-392
C57	Capacitor, .1 µF, 50 V, +80%–20%, Cer.	122002-104
C58, C59	Capacitor, 6800 pF, 50 V, ±10%, Cer.	122015-682
C60	Capacitor, .1 µF, 50 V, ±10%, Cer.	122015-104
C61, C62	Capacitor, .1 µF, 50 V, +80%–20%, Cer.	122002-104
C63	Capacitor, 1000 pF, 100 V, ±10%, Cer.	122015-102
C64	Capacitor, 3900 pF, 50 V, ±10%, Cer.	122015-392
C65–C70	Capacitor, .1 µF, 50 V, +80%–20%, Cer.	122002-104
C72	Capacitor, 1000 pF, 100 V, ±10%, Cer.	122015-102
C73	Capacitor, 2200 pF, 50 V, ±10%, Cer.	122015-222
C75	Capacitor, 1000 pF, 100 V, ±10%, Cer.	122015-102
C76	Capacitor, 2200 pF, 50 V, ±10%, Cer.	122015-222
C77–C81	Capacitor, .1 µF, 50 V, +80%–20%, Cer.	122002-104
C83	Capacitor, 10 µF, 25 V, Electrolytic	124009-106
C85, C86	Capacitor, 1000 pF, 100 V, ±10%, Cer.	122015-102
C87–C89	Capacitor, .1 µF, 50 V, +80%–20%, Cer.	122002-104
CR1, CR2	Diode, MV5053, Light-Emitting	131027-002
CR3,CR6–CR9	Diode, 1N4001	131048-001
CR10	Diode, 1N5818	131025-001
CR11–CR14	Diode, 1N4001	131048-001

JSA3S PCB Assembly (EPROM Version), Continued
Parts List

Designator	Description	Part No.
GND2	Test Point	179051-001
HS1, HS2	Heat Sink, TDA2030	178190-024
JAUD	Conn, 36 Ckt, .1 Bottom Entry	179299-036
R1	Resistor, 1.2 KΩ, ±5%, 1/8 W	110027-122
R2	Resistor, 470 Ω, ±5%, 1/8 W	110027-471
R3	Resistor, 33 KΩ, ±5%, 1/8 W	110027-333
R4, R5	Resistor, 3.3 KΩ, ±5%, 1/8 W	110027-332
R6	Resistor, 33 KΩ, ±5%, 1/8 W	110027-333
R9, R12–R15	Resistor, 1 KΩ, ±5%, 1/8 W	110027-102
R16–R19	Resistor, 470 Ω, ±5%, 1/8 W	110027-471
R20	Resistor, 1 KΩ, ±5%, 1/8 W	110027-102
R22	Resistor, 10 KΩ, ±5%, 1/8 W	110027-103
R23	Resistor, 1 KΩ, ±5%, 1/8 W	110027-102
R24	Resistor, 33 KΩ, ±5%, 1/8 W	110027-333
R25	Resistor, 1 Ω, ±5%, 1/8 W	110027-010
R26	Resistor, 33 KΩ, ±5%, 1/8 W	110027-333
R27	Resistor, 1 KΩ, ±5%, 1/8 W	110027-102
R28	Resistor, 33 KΩ, ±5%, 1/8 W	110027-333
R29	Resistor, 1 Ω, ±5%, 1/8 W	110027-010
R30	Resistor, 1 KΩ, ±5%, 1/8 W	110027-102
R31, R32	Resistor, 33 KΩ, ±5%, 1/8 W	110027-333
R33	Resistor, 1 Ω, ±5%, 1/8 W	110027-010
R34	Resistor, 33 KΩ, ±5%, 1/8 W	110027-333
R35	Resistor, 1 KΩ, ±5%, 1/8 W	110027-102
R36, R37	Resistor, 33 KΩ, ±5%, 1/8 W	110027-333
R38	Resistor, 1 Ω, ±5%, 1/8 W	110027-010
R39, R40, R44	Resistor, 10 Ω, ±5%, 1/8 W	110027-100
R45	Resistor, 27 KΩ, ±5%, 1/8 W	110027-273
R46	Resistor, 15 KΩ, ±5%, 1/8 W	110027-153
R47	Resistor, 10 KΩ, ±5%, 1/8 W	110027-103
R48	Resistor, 2 KΩ, ±5%, 1/8 W	110027-202
R49	Resistor, 7.5 KΩ, ±5%, 1/8 W	110027-752
R50, R51	Resistor, 6.8 KΩ, ±5%, 1/8 W	110027-682
R52	Resistor, 10 Ω, ±5%, 1/8 W	110027-100
R54	Resistor, 27 KΩ, ±5%, 1/8 W	110027-273
R55	Resistor, 15 KΩ, ±5%, 1/8 W	110027-153
R56	Resistor, 10 KΩ, ±5%, 1/8 W	110027-103
R57	Resistor, 2 KΩ, ±5%, 1/8 W	110027-202
R58	Resistor, 7.5 KΩ, ±5%, 1/8 W	110027-752
R59, R60	Resistor, 6.8 KΩ, ±5%, 1/8 W	110027-682
R61	Resistor, 10 Ω, ±5%, 1/8 W	110027-100
R64	Resistor, 7.5 KΩ, ±5%, 1/8 W	110027-752
R65	Resistor, 15 KΩ, ±5%, 1/8 W	110027-153
R66	Resistor, 30 KΩ, ±5%, 1/8 W	110027-303
R67	Resistor, 3.9 KΩ, ±5%, 1/8 W	110027-392
R69	Resistor, 7.5 KΩ, ±5%, 1/8 W	110027-752
R70	Resistor, 15 KΩ, ±5%, 1/8 W	110027-153
R71	Resistor, 30 KΩ, ±5%, 1/8 W	110027-303
R72	Resistor, 33 KΩ, ±5%, 1/8 W	110027-333
R73	Resistor, 5.1 KΩ, ±5%, 1/8W	110027-512
R74, R77	Resistor, 12 KΩ, ±5%, 1/8 W	110027-123
R78	Resistor, 33 KΩ, ±5%, 1/8 W	110027-333
R79	Resistor, 3.3 KΩ, ±5%, 1/8 W	110027-332
R80	Resistor, 5.1 KΩ, ±5%, 1/8W	110027-512
R81	Resistor, 12 KΩ, ±5%, 1/8 W	110027-123
R83	Resistor, 3.9 KΩ, ±5%, 1/8 W	110027-392
R84	Resistor, 12 KΩ, ±5%, 1/8 W	110027-123
R86	Resistor, 3.3 KΩ, ±5%, 1/8 W	110027-332
R87	Resistor, 82 KΩ, ±5%, 1/8 W	110027-823
R88	Resistor, 5.1 KΩ, ±5%, 1/8W	110027-512
R89	Resistor, 620 KΩ, ±5%, 1/8 W	110027-624
R90	Resistor, 10 KΩ, ±5%, 1/8 W	110027-103
R91	Resistor, 39 KΩ, ±5%, 1/8 W	110027-393
R92	Resistor, 160 KΩ, ±5%, 1/8 W	110027-164
R93	Resistor, 330 KΩ, ±5%, 1/8 W	110027-334
R94	Resistor, 20 KΩ, ±5%, 1/8 W	110027-203
R95	Resistor, 82 KΩ, ±5%, 1/8 W	110027-823
R96	Resistor, 5.1 KΩ, ±5%, 1/8W	110027-512
R97	Resistor, 620 KΩ, ±5%, 1/8 W	110027-624
R98	Resistor, 10 KΩ, ±5%, 1/8 W	110027-103
R99	Resistor, 39 KΩ, ±5%, 1/8 W	110027-393
R100	Resistor, 160 KΩ, ±5%, 1/8 W	110027-164
R101	Resistor, 330 KΩ, ±5%, 1/8 W	110027-334
R102	Resistor, 20 KΩ, ±5%, 1/8 W	110027-203
R103	Resistor, 470 Ω, ±5%, 1/8 W	110027-471
R105	Resistor, 560 Ω, ±5%, 1/8 W	110027-561
R106	Resistor, 10 KΩ, ±5%, 1/8 W	110027-103
(HS1,HS2)	Thermal Compound	107031-001

NOTES

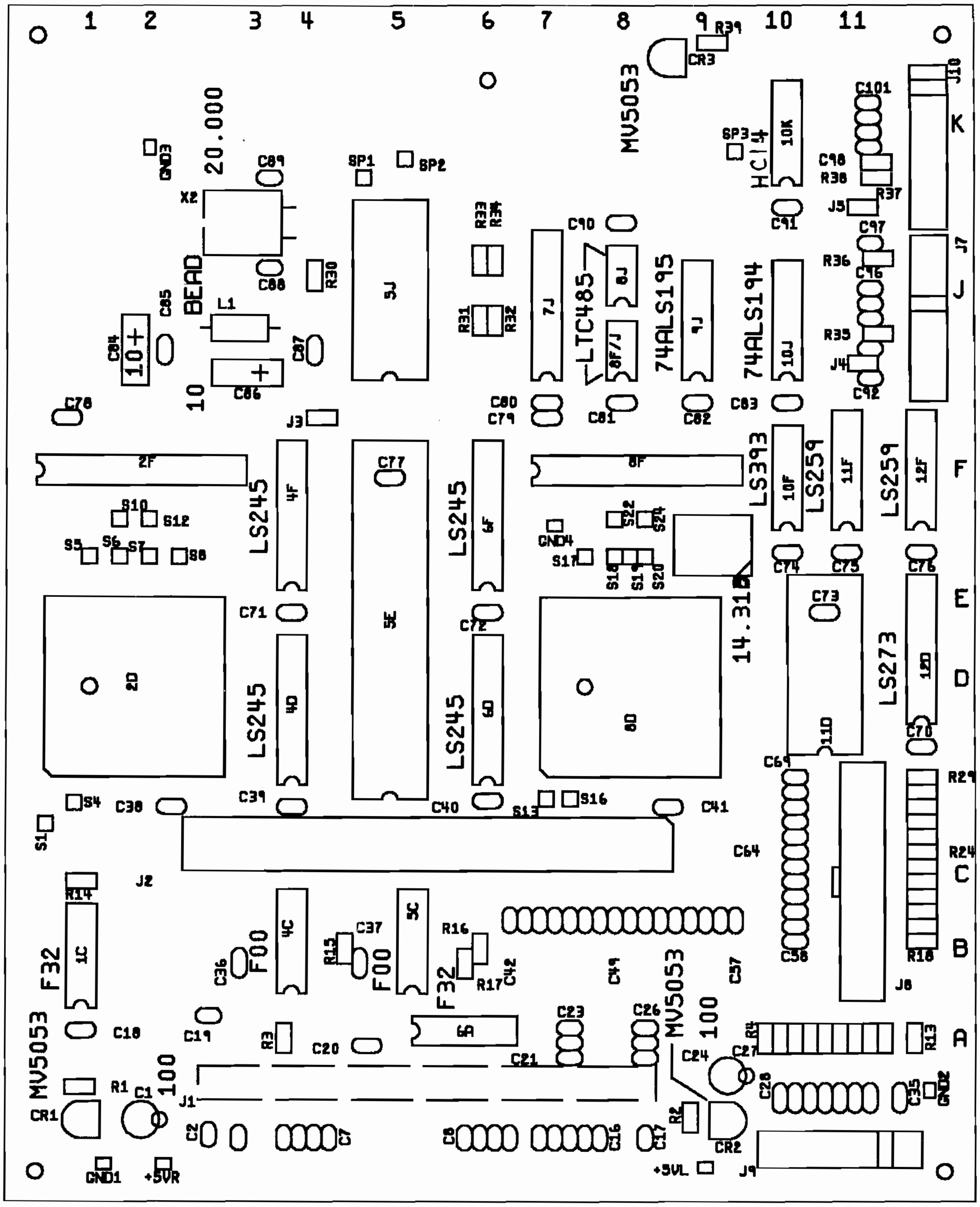


Figure 4-10 CLARN II PCB Assembly

A051092-XX D

CLARN II PCB Assembly
Parts List

Designator	Description	Part No.
1J	Socket, 28 Pin, .600	179257-028
2D	Socket, 68 Pin, PLCC	179237-068
2F	Socket, 28 Pin, .300	179259-028
5E	Socket, 48 Pin, .600	179257-048
5J	Socket, 24 Pin, .600	179257-024
7J	Socket, 20 Pin, .300	179259-020
8D	Socket, 68 Pin, PLCC	179237-068
8F	Socket, 28 Pin, .300	179259-028
++1005VL	Test Point	179051-001
++1005VR	Test Point	179051-001
GND1–4	Test Point	179051-001
1C	IC, 74F32	137486-001
2F	IC, RAM, 8Kx8, 45 ns, .3	137667-045
4C	IC, 74F00	137327-001
4D, 4F	IC, 74LS245	137134-001
5C	IC, 74F00	137327-001
5E	IC, SRAM DP, 2Kx8, 55 ns, .6	137681-055
5J	IC, Controller, Univ Lan, 2Kx8RAM	137710-001
6A	IC, 74F32	137486-001
6D, 6F	IC, 74LS245	137134-001
7J	GAL16V8, 25 ns	136095-0070
8D	1020 FPGA	136095-0072
8F	IC, RAM, 8Kx8, 45 ns, .3	137667-045
8F/J, 8J	IC, LTC485	137711-001
10K	IC, 74HC14	137605-001
11F	IC, 74LS259	137137-001
C1	Capacitor, 100 µF, 16 V, Electrolytic, Radial	123013-107
C2	Capacitor, 47 pF, 100 V, ±5%, Cer.	122016-470
C3	Capacitor, 33 pF, 100 V, ±5%, Cer.	122016-330
C4, C5	Capacitor, 100 pF, 100 V, ±5%, Cer.	122016-101
C6.-C8	Capacitor, 33 pF, 100 V, ±5%, Cer.	122016-330
C9.-, C17	Capacitor, 100 pF, 100 V, ±5%, Cer.	122016-101
C18	Capacitor, .1 µF, 50 V, +80%–20%, Ceramic	122002-104
C19	Capacitor, 33 pF, 100 V, ±5%, Cer.	122016-330
C20	Capacitor, .1 µF, 50 V, +80%–20%, Ceramic	122002-104
C21–C26	Capacitor, 100 pF, 100 V, ±5%, Cer.	122016-101
C27	Capacitor, 100 µF, 16 V, Electrolytic, Radial	123013-107
C36–C41	Capacitor, .1 µF, 50 V, +80%–20%, Cer.	122002-104

Designator	Description	Part No.
C42	Capacitor, 33 pF, 100 V, ±5%, Cer.	122016-330
C43–C57	Capacitor, 100 pF, 100 V, ±5%, Cer.	122016-101
C70–C83	Capacitor, .1 µF, 50 V, +80%–20%, Cer.	122002-104
C84	Capacitor, 10 µF, 25 V, Electrolytic	124009-106
C85	Capacitor, .1 µF, 50 V, +80%–20%, Cer.	122002-104
C86	Capacitor, 10 µF, 25 V, Electrolytic	124009-106
C87	Capacitor, .1 µF, 50 V, +80%–20%, Cer.	122002-104
C88, C89	Capacitor, 33 pF, 100 V, ±5%, Cer.	122016-330
C90, C91	Capacitor, .1 µF, 50 V, +80%–20%, Cer.	122002-104
C92–C95	Capacitor, 47 pF, 100 V, ±5%, Cer.	122016-470
C96–C99	Capacitor, 100 pF, 100 V, ±5%, Cer.	122016-101
C100, C101	Capacitor, 1000 pF, 100 V, ±10%, Cer.	122015-102
CR1–CR3	Diode, LED, MV5053	131027-002
J1	Connector, 60 Circuit, Rec, .1 x .1C	179303-060
J2	Connector, 60 Circuit, Header, 4 Wall, .1 x .1C	179021-060
J3–J5	Connector, 2 Circuit, Hdr., .100 Ctr	179048-002
J7	Connector, 11 Circuit, Header, .100 Ctr, Key 5	179118-011
J10	Connector, 11 Circuit, Header, .100 Ctr, Key 2	179118-011
L1	Inductor, Ferrite Bead, N12N	141003-005
R1, R2	Resistor, 220 Ω, ±5%, 1/8 W	110027-221
R3	Resistor, 10 Ω, ±5%, 1/8 W	110027-100
R14	Resistor, 470 Ω, ±5%, 1/8 W	110027-471
R15	Resistor, 1 KΩ, ±5%, 1/8 W	110027-102
R16	Resistor, 470 Ω, ±5%, 1/8 W	110027-471
R17	Resistor, 1 KΩ, ±5%, 1/8 W	110027-102
R30	Resistor, 330 Ω, ±5%, 1/8 W	110027-331
R31–R34	Resistor, 1 KΩ, ±5%, 1/8 W	110027-102
R35–R38	Resistor, 100 Ω, ±5%, 1/8 W	110027-101
R39	Resistor, 150 Ω, ±5%, 1/8 W	110027-151
X1	Crystal, 14.318 MHz, Osc. Module, .3 x .3 DIP	144009-001
X2	Crystal, 20.000 MHz	144000-003

NOTES

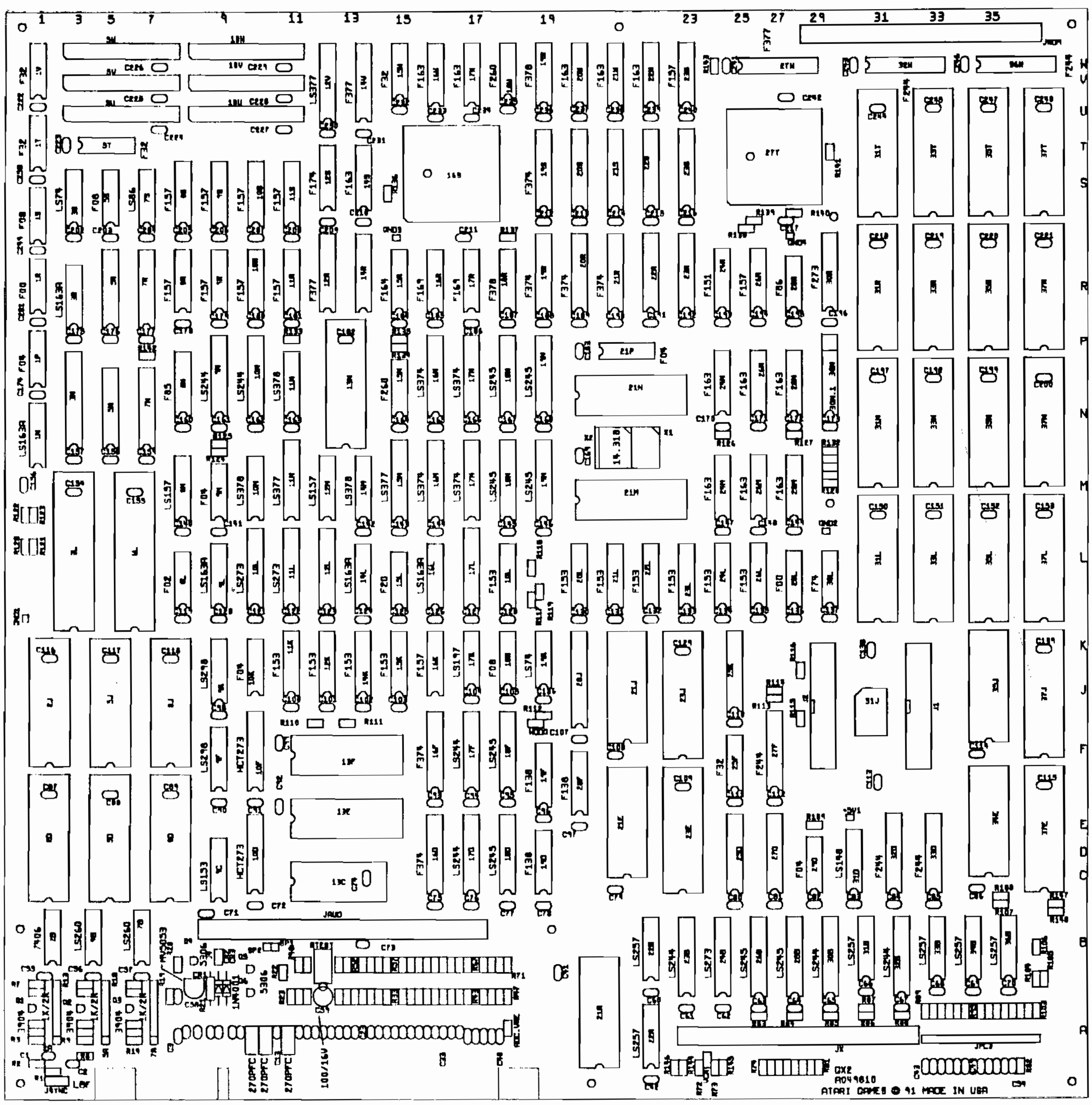


Figure 4-11 Space Lords Game PCB Assembly (EPROM Version)

A049810-04 A

Space Lords Game PCB Assembly
Parts List

Designator	Description	Part No.
2D, 2J	Socket, 32 Pin, .600	179257-032
3L	Socket, 40 Pin, .600	179257-040
3N	Socket, 24 Pin, .300	179259-024
5D, 5J	Socket, 32 Pin, .600	179257-032
5N, 5R	Socket, 20 Pin, .300	179259-020
5U, 5V, 5W	Socket, Zip 28	179302-028
6L	Socket, 40 Pin, .600	179257-040
7N, 7R	Socket, 20 Pin, .300	179259-020
8D, 8J	Socket, 32 Pin, .600	179257-032
10U, 10V, 10W	Socket, Zip 28	179302-028
12L	Socket, 20 Pin, .300	179259-020
13C	Socket, 24 Pin, .600	179257-024
13E, 13F	Socket, 24 Pin, .300	179259-024
13N	Socket, 32 Pin, .600	179257-032
14R	Socket, 20 Pin, .300	179259-020
16S	Socket, 68 Pin, Plcc	179237-068
17L	Socket, 20 Pin, .300	179259-020
20J	Socket, 24 Pin, .300	179259-024
20S	Socket, 20 Pin, .300	179259-020
21A, 21E, 21J, 21M, 21N	Socket, 28 Pin, .600	179257-028
21S, 22R, 22S	Socket, 20 Pin, .300	179259-020
23E, 23J	Socket, 32 Pin, .600	179257-032
23R, 23S, 25D, 25K, 27D	Socket, 20 Pin, .300	179259-020
27T	Socket, 68 Pin, PLCC	179237-068
30N	Socket, 20 Pin, .300	179259-020
31L, 31N, 31R, 31T, 33L, 33N, 33R, 33T	Socket, 32 Pin, .600	179257-032
34E, 35J	Socket, 28 Pin, .600	179257-028
35L, 35N, 35R, 35T, 37E, 37J, 37L, 37N, 37R, 37T	Socket, 32 Pin, .600	179257-032
+	IC, 74F163	137345-001
+	EPROM, 128K x 8, 100 ns	136094-0021
+	EPROM, 512K x 8, 100 ns	136094-0053
1N	IC, 74LS163 A	137114-001
1R	IC, 74F00	137327-001
1S	IC, 74F04	137437-001
1U	IC, 74F32	137486-001
2A	Res, R/2R, 1K/2K	118016-001
2B	IC, 7406	137052-001

Designator	Description	Part No.
2D	EPROM, 512K x 8, 100 ns	136094-0030
3L	IC, SOS	137550-001
3N	GAL20V8, 25 ns	136094-0019
3R	IC, 74LS163 A	137114-001
3S	IC, 74LS74	137023-001
4B	IC, 74LS260	137332-001
5A	Res, R/2R, 1K/2K	118016-001
5D	EPROM, 512K x 8, 100 ns	136094-0031
5N	GAL16V8, 25 ns	136094-0010
5R	GAL16V8, 25 ns	136094-0011
5S	IC, 74F08	137483-001
5T	IC, 74F32	137486-001
5U, 5V, 5W	IC, VRAM, 256K x 4, 100 ns	137682-100
6L	IC, PFHS	137419-104
7A	Res, R/2R, 1K/2K	118016-001
7B	IC, 74LS260	137332-001
7N	GAL16V8, 25 ns	136094-0009
7R	GAL16V8, 25 ns	136094-0012
7S	IC, 74LS86	137079-001
8D	EPROM, 512K x 8, 100 ns	136094-0032
8L	IC, 74F02	137481-001
8M	IC, 74LS157	137029-001
8N	IC, 74F85	137685-001
8R, 8S	IC, 74F157	137494-001
9C	IC, 74LS153	137104-001
9F, 9K	IC, 74LS298	137201-001
9L	IC, 74LS163 A	137114-001
9M	IC, 74F04	137437-001
9N	IC, 74LS244	137038-001
9R, 9S	IC, 74F157	137494-001
10D, 10F	IC, 74HCT273	137655-001
10K	IC, 74F04	137437-001
10L	IC, 74LS273	137040-001
10M	IC, 74LS378	137305-001
10N	IC, 74LS244	137038-001
10R, 10S	IC, 74F157	137494-001
10U, 10V, 10W	256K x 4, 100 ns	IC, VRAM, 137682-100
11K	IC, 74F153	137492-001
11L	IC, 74LS273	137040-001
11M	IC, 74LS377	137145-001
11N	IC, 74LS378	137305-001
11R, 11S	IC, 74F157	137494-001

Space Lords Game PCB Assembly, Continued
Parts List

Designator	Description	Part No.
12K	IC, 74F153	137492-001
12L	GAL16V8, 25 ns	136094-0007
12M	IC, 74LS157	137029-001
12R	IC, 74F377	137622-001
12S	IC, 74F174	137531-001
12V	IC, 74LS377	137145-001
13C	IC, 28C16-200, 200 ns	137648-200
13E, 13F	IC, RAM, 2K x 8, 35 ns, .3	137534-001
13N	EPROM, 128K x 8, 100 ns	136094-0025
14K	IC, 74F153	137492-001
14L	IC, 74LS163 A	137114-001
14M	IC, 74LS378	137305-001
14R	GAL16V8, 10 ns	136094-0006
14S	IC, 74F163	137345-001
14V	IC, 74F377	137622-001
15K	IC, 74F153	137492-001
15L	IC, 74F20	137530-001
15M	IC, 74LS377	137145-001
15N	IC, 74F260	137570-001
15R	IC, 74F169	137496-001
15W	IC, 74F32	137486-001
16D, 16F	IC, 74F374	137420-001
16K	IC, 74F157	137494-001
16L	IC, 74LS163 A	137114-001
16M, 16N	IC, 74LS374	137144-001
16R	IC, 74F169	137496-001
16S	FPLA, 20 ns	136094-0004
16W	IC, 74F163	137345-001
17D, 17F	IC, 74LS244	137038-001
17K	IC, 74LS197	137240-001
17L	GAL16V8, 25 ns	136094-0008
17M, 17N	IC, 74LS374	137144-001
17R	IC, 74F169	137496-001
17W	IC, 74F163	137345-001
18D, 18F	IC, 74LS245	137134-001
18K	IC, 74F08	137483-001
18L	IC, 74F153	137492-001
18M, 18N	IC, 74LS245	137134-001
18R	IC, 74F378	137612-001
18W	IC, 74F260	137570-001
19D, 19F	IC, 74F138	137521-001
19K	IC, 74LS74	137023-001

Designator	Description	Part No.
19M, 19N	IC, 74LS245	137134-001
19R, 19S	IC, 74F374	137420-001
19W	IC, 74F378	137612-001
20F	IC, 74F138	137521-001
20J	GAL6001, 35 ns	136094-0005
20L	IC, 74F153	137492-001
20R	IC, 74F374	137420-001
20S	PROM, 82S147	136094-0003
20W	IC, 74F163	137345-001
21A	IC, ADC0809	137243-001
21E, 21J	IC, RAM, 32K x 8, 70 ns, .6	137615-070
21L	IC, 74F153	137492-001
21M, 21N	IC, RAM, 32K x 8, 70 ns, .6	137615-070
21P	IC, 74F04	137437-001
21R	IC, 74F374	137420-001
21S	PROM, 82S147	136094-0002
21W	IC, 74F163	137345-001
22A, 22B	IC, 74LS257	137136-001
22L	IC, 74F153	137492-001
22R	GAL16V8, 25 ns	136094-0014
22S	PROM, 82S147	136094-0001
22W	IC, 74F163	137345-001
23B	IC, 74LS244	137038-001
23E	EPROM, 128K x 8, 100 ns	136094-0221
23J	EPROM, 128K x 8, 100 ns	136094-0222
23L	IC, 74F153	137492-001
23R	GAL16V8, 25 ns	136094-0016
23S	GAL16V8, 25 ns	136094-0015
23W	IC, 74F157	137494-001
24B	IC, 74LS273	137040-001
24L	IC, 74F153	137492-001
24M, 24N	IC, 74F163	137345-001
24R	IC, 74F151	137490-001
25D	GAL16V8, 25 ns	136094-0013
25F	IC, 74F32	137486-001
25K	GAL16V8, 25 ns	136094-0018
26B	IC, 74LS245	137134-001
26L	IC, 74F153	137492-001
26M, 26N	IC, 74F163	137345-001
26R	IC, 74F157	137494-001
27D	GAL16V8, 25 ns	136094-0017
27F	IC, 74F244	137502-001

Space Lords Game PCB Assembly, Continued
Parts List

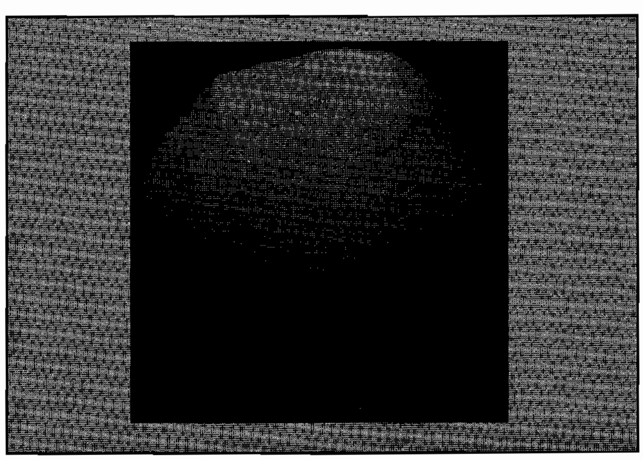
Designator	Description	Part No.
27T	IC, CPU, PLCC	137658-101
27W	IC, 74F377	137622-001
28B	IC, 74LS245	137134-001
28L	IC, 74F00	137327-001
28M, 28N	IC, 74F163	137345-001
28R	IC, 74F86	137649-001
29D	IC, 74F04	137437-001
30B	IC, 74LS244	137038-001
30L	IC, 74F74	137436-001
30N	IC, 74F138	137521-001
30R	IC, 74F273	137610-001
31B	IC, 74LS257	137136-001
31D	IC, 74LS148	137417-001
31J	IC, CPU, 68EC020, 16 MHz, 100PQFP	137691-001
31L	EPROM, 512K x 8, 100 ns	136094-0040
31N	EPROM, 512K x 8, 100 ns	136094-0041
31R	EPROM, 512K x 8, 100 ns	136094-0048
31T	EPROM, 512K x 8, 100 ns	136094-0049
32B	IC, 74LS244	137038-001
32D, 32W	IC, 74F244	137502-001
33B	IC, 74LS257	137136-001
33D	IC, 74F244	137502-001
33L	EPROM, 512K x 8, 100 ns	136094-0042
33N	EPROM, 512K x 8, 100 ns	136094-0043
33R	EPROM, 512K x 8, 100 ns	136094-0050
33T	EPROM, 512K x 8, 100 ns	136094-0051
34B	IC, 74LS257	137136-001
34E, 35J	IC, RAM, 32K x 8, 70 ns, .6	137615-070
35L	EPROM, 512K x 8, 100 ns	136094-0044
35N	EPROM, 512K x 8, 100 ns	136094-0045
35R	EPROM, 512K x 8, 100 ns	136094-0052
35T	EPROM, 512K x 8, 100 ns	136094-0053
36B	IC, 74LS257	137136-001
36W	IC, 74F244	137502-001
37E	EPROM, 128K x 8, 100 ns	136094-0223
37J	EPROM, 128K x 8, 100 ns	136094-0224
37L	EPROM, 512K x 8, 100 ns	136094-0046
37N	EPROM, 512K x 8, 100 ns	136094-0047
ADC.VRE	Connector, 2 Circuit, Header, .100 Ctr	179048-002
C1, C2	Capacitor, 100 pF, 100 V, ±5%, Ceramic	122016-101
C3	Capacitor, .1 µF, 50 V, +80% –20%, Ceramic	122002-104

Designator	Description	Part No.
C4, C5, C7, C8	Capacitor, .01 µF, 50 V, +80% –20%, Ceramic	122002-103
C9, C10	Capacitor, 1000 pF, 100 V, ±10%, Ceramic 122015-102	
C11, C12	Capacitor, 270 PFC, 50 V, EMI Filter	140006-271
C13	Capacitor, 100 pF, 100 V, ±5%, Ceramic	122016-101
C14	Capacitor, 270 PFC, 50 V, EMI Filter	140006-271
C15, C16	Capacitor, .1 µF, 50 V, +80% –20%, Ceramic	122002-104
C17–C19	Capacitor, .01 µF, 50 V, +80% –20%, Ceramic	122002-103
C20, C21	Capacitor, .1 µF, 50 V, +80% –20%, Ceramic	122002-104
C22–C29	Capacitor, .01 µF, 50 V, +80% –20%, Ceramic	122002-103
C30–C35, C36–C58	Capacitor, .1 µF, 50 V, +80% –20%, Ceramic	122002-104
C59	Capacitor, 100 µF, 16 V, Electrolytic, Radial	123013-107
C60–C72	Capacitor, .1 µF, 50 V, +80% –20%, Ceramic	122002-104
C73	Capacitor, 100 pF, 100 V, ±5%, Ceramic	122016-101
C74–C248	Capacitor, .1 µF, 50 V, +80% –20%, Ceramic	122002-104
CR1	Diode, MV5053, Light Emitting	131027-002
CR2, CR3	Diode, 1N4001	131048-001
GND1,GND2	Test Point	179051-001
J4	Connector, 2 Circuit, Header, .100 Ctr	179048-002
JAUD	Conn, 36 Ckt, .1 Hdr, Long	179300-036
JPL3	Conn, 15 Ckt, Hdr, .100 Ctr	179118-015
JROM	Conn, 60 Ckt, Hdr, .1 x .1C	179291-060
JSYNC	Conn, 3 Ckt, Hdr, .100 Ctr	179048-003
JX	Conn, 60 Ckt, Hdr, .1 x .1C	179291-060
Q1–Q3	Transistor, 2N3904	133041-001
Q4–Q6	Transistor, 2N5306	133033-001
R+	Resistor, 1 KΩ, ±5%, 1/8 W	110027-102
R1, R2	Resistor, 470 Ω, ±5%, 1/8 W	110027-471
R3	Resistor, 10 Ω, ±5%, 1/8 W	110027-100
R4	Resistor, 100 Ω, ±5%, 1/8 W	110027-101
R5	Resistor, 15 Ω, ±5%, 1/8 W	110027-150

Space Lords Game PCB Assembly, Continued
Parts List

Designator	Description	Part No.
R6	Resistor, 1 KΩ, ±5%, 1/8 W	110027-102
R7	Resistor, 2.4 KΩ, ±5%, 1/8 W	110027-242
R8	Resistor, 470 Ω, ±5%, 1/8 W	110027-471
R9	Resistor, 10 Ω, ±5%, 1/8 W	110027-100
R10	Resistor, 100 Ω, ±5%, 1/8 W	110027-101
R11	Resistor, 15 Ω, ±5%, 1/8 W	110027-150
R12	Resistor, 1 KΩ, ±5%, 1/8 W	110027-102
R13	Resistor, 2.4 KΩ, ±5%, 1/8 W	110027-242
R14	Resistor, 10 Ω, ±5%, 1/8 W	110027-100
R15	Resistor, 100 Ω, ±5%, 1/8 W	110027-101
R16	Resistor, 15 Ω, ±5%, 1/8 W	110027-150
R17	Resistor, 1 KΩ, ±5%, 1/8 W	110027-102
R18	Resistor, 2.4 KΩ, ±5%, 1/8 W	110027-242
R19	Resistor, 100 KΩ, ±5%, 1/8 W	110027-104
R20	Resistor, 240 Ω, ±5%, 1/8 W	110027-241
R21	Resistor, 0 Ω, ±5%, 1/4 W	110005-001
R22–R27	Resistor, 1 KΩ, ±5%, 1/8 W	110027-102
R28–R35	Resistor, 470 Ω, ±5%, 1/8 W	110027-471
R36–R41	Resistor, 1 KΩ, ±5%, 1/8 W	110027-102
R42, R43	Resistor, 10 KΩ, ±5%, 1/8 W	110027-103
R44	Resistor, 100 Ω, ±5%, 1/8 W	110027-101
R45	Resistor, 220 Ω, ±5%, 1/8 W	110027-221
R46, R47	Resistor, 100 Ω, ±5%, 1/8 W	110027-101
R48, R49, R52–R59	Resistor, 1 KΩ, ±5%, 1/8 W	110027-102
R60–R63	Resistor, 470 Ω, ±5%, 1/8 W	110027-471
R66–R71	Resistor, 10 KΩ, ±5%, 1/8 W	110027-103
R72	Resistor, 1 KΩ, ±5%, 1/8 W	110027-102
R73	Resistor, 10 KΩ, ±5%, 1/8 W	110027-103
R74–R77	Resistor, 470 Ω, ±5%, 1/8 W	110027-471
R78–R81	Resistor, 1 KΩ, ±5%, 1/8 W	110027-102
R82–R86	Resistor, 470 Ω, ±5%, 1/8 W	110027-471
R87	Resistor, 10 KΩ, ±5%, 1/8 W	110027-103

Designator	Description	Part No.
R88	Resistor, 470 Ω, ±5%, 1/8 W	110027-471
R89–R100	Resistor, 1 KΩ, ±5%, 1/8 W	110027-102
R101–R106	Resistor, 470 Ω, ±5%, 1/8 W	110027-471
R108	Resistor, 10 Ω, ±5%, 1/8 W	110027-100
R109	Resistor, 1 KΩ, ±5%, 1/8 W	110027-102
R110	Resistor, 10 Ω, ±5%, 1/8 W	110027-100
R112	Resistor, 10 KΩ, ±5%, 1/8 W	110027-103
R113, R114	Resistor, 1 KΩ, ±5%, 1/8 W	110027-102
R115	Resistor, 10 KΩ, ±5%, 1/8 W	110027-103
R116	Resistor, 1 KΩ, ±5%, 1/8 W	110027-102
R117	Resistor, 470 Ω, ±5%, 1/8 W	110027-471
R118	Resistor, 1 KΩ, ±5%, 1/8 W	110027-102
R119	Resistor, 10 KΩ, ±5%, 1/8 W	110027-103
R120, R123, R124	Resistor, 10 Ω, ±5%, 1/8 W	110027-100
R125	Resistor, 10 KΩ, ±5%, 1/8 W	110027-103
R126, R127	Resistor, 1 KΩ, ±5%, 1/8 W	110027-102
R128, R130–R133	Resistor, 10 Ω, ±5%, 1/8 W	110027-100
R135–R139	Resistor, 1 KΩ, ±5%, 1/8 W	110027-102
R140	Resistor, 470 Ω, ±5%, 1/8 W	110027-471
R141–R145	Resistor, 1 KΩ, ±5%, 1/8 W	110027-102
R146	Resistor, 2.2 KΩ, ±5%, 1/8 W	110027-222
STEST	Switch, Slide, SPDT	160040-001
VCR	Connector, 2 Circuit, Header, .100 Ctr	179048-002
WDOG	Connector, 2 Circuit, Header, .100 Ctr	179048-002
X2	Crystal, 14.318M, Osc. Module, .3 x .3 DIP	144009-001

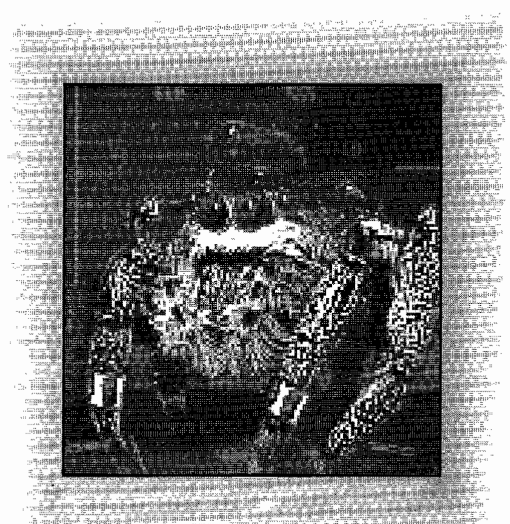


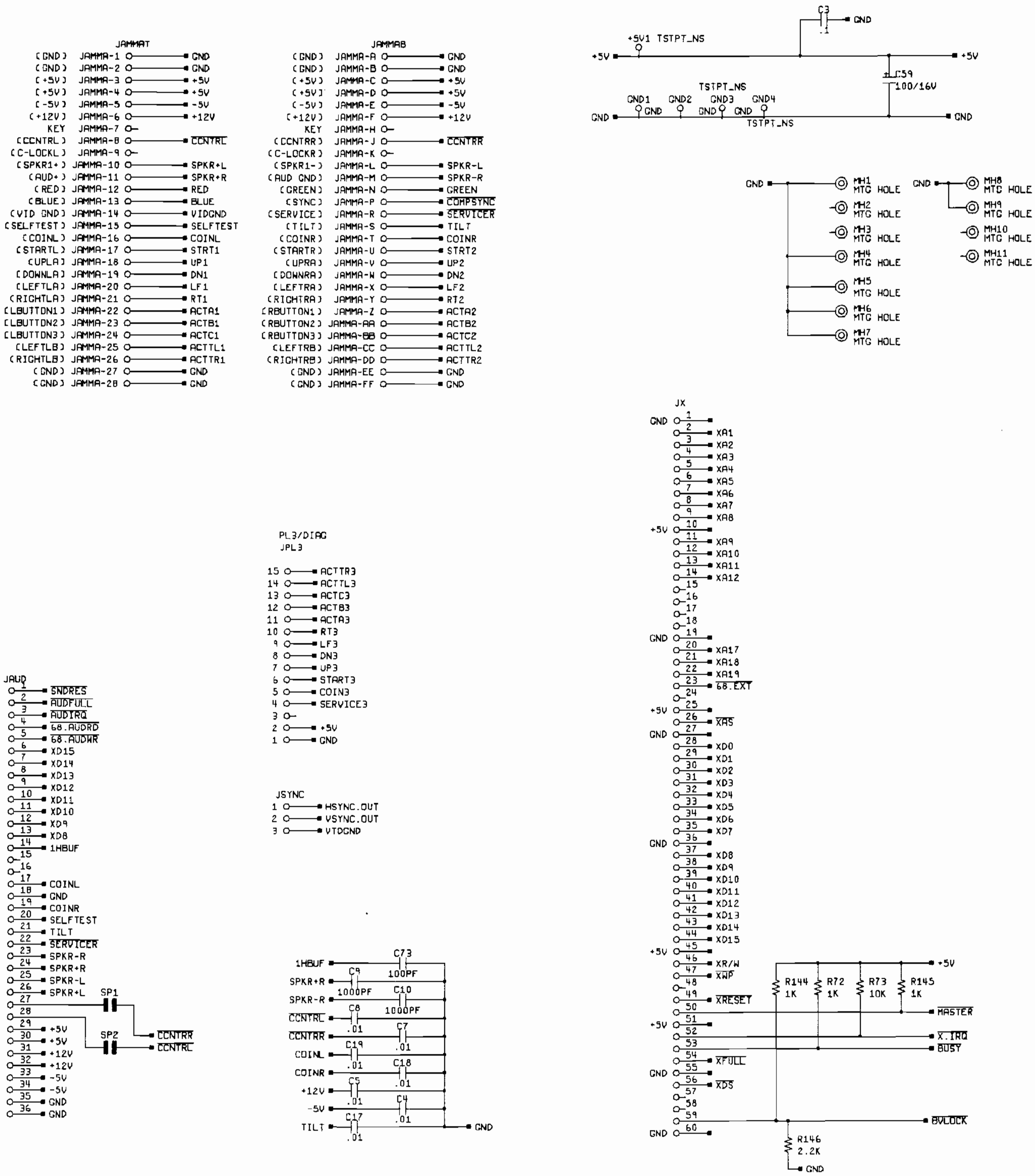
CHAPTER 5

Schematic Diagrams

Introduction

THIS CHAPTER contains the schematic diagrams for all the Space Lords™ printed-circuit boards, including the game PCB (also called GX2), the JSA 3S PCB, the CLARN II PCB, and the JAMMA Filter PCB. In addition, this chapter includes wiring diagrams for the entire game (including the power supply), and the coin door. The PCB *assembly drawings* are illustrated in Chapter 4, Parts Illustrations.





JAMMAT
(GND) JAMMA-1 GND
(GND) JAMMA-2 GND
(+5V) JAMMA-3 +5V
(+5V) JAMMA-4 +5V
(-5V) JAMMA-5 -5V
(+12V) JAMMA-6 +12V
KEY JAMMA-7
(CCNTRL) JAMMA-8 CCNTRL
(C-LOCKL) JAMMA-9
(SPKR1+) JAMMA-10 SPKR+L
(AUD+) JAMMA-11 SPKR+R
(RED) JAMMA-12 RED
(BLUE) JAMMA-13 BLUE
(VID GND) JAMMA-14 VIDGND
(SELFTEST) JAMMA-15 SELFTEST
(COINL) JAMMA-16 COINL
(STARTL) JAMMA-17 STRT1
(UPLA) JAMMA-18 UP1
(DOWNLA) JAMMA-19 DN1
(LEFTLA) JAMMA-20 LF1
(RIGHTLA) JAMMA-21 RT1
(LBUTTON1) JAMMA-22 ACTA1
(LBUTTON2) JAMMA-23 ACTB1
(LBUTTON3) JAMMA-24 ACTC1
(LEFTLB) JAMMA-25 ACTTL1
(RIGHTLB) JAMMA-26 ACTTR1
(GND) JAMMA-27 GND
(GND) JAMMA-28 GND
JAMMAB
(GND) JAMMA-A GND
(GND) JAMMA-B GND
(+5V) JAMMA-C +5V
(+5V) JAMMA-D +5V
(-5V) JAMMA-E -5V
(+12V) JAMMA-F +12V
KEY JAMMA-H
(CCNTRR) JAMMA-J CCNTRR
(C-LOCKR) JAMMA-K
(SPKR1-) JAMMA-L SPKR-L
(AUD GND) JAMMA-M SPKR-R
(GREEN) JAMMA-N GREEN
(SYNC) JAMMA-P COMPSYNC
(SERVICE) JAMMA-R SERVICER
(TILT) JAMMA-S TILT
(COINR) JAMMA-T COINR
(STARTR) JAMMA-U STRT2
(UPRA) JAMMA-V UP2
(DOWNRA) JAMMA-W DN2
(LEFTRA) JAMMA-X LF2
(RIGHTRA) JAMMA-Y RT2
(RBUTTON1) JAMMA-Z ACTA2
(RBUTTON2) JAMMA-AA ACTB2
(RBUTTON3) JAMMA-BB ACTC2
(LEFTRB) JAMMA-CC ACTTL2
(RIGHTRB) JAMMA-DD ACTTR2
(GND) JAMMA-EE GND
(GND) JAMMA-FF GND
C3 .1 GND
+5V1 TSTPT_NS
+5V +5V
C59 100/16V
TSTPT_NS
GND1 GND2 GND3 GND4
GND GND GND GND GND
TSTPT_NS
GND MH1 MTG HOLE
MH2 MTG HOLE
MH3 MTG HOLE
MH4 MTG HOLE
MH5 MTG HOLE
MH6 MTG HOLE
MH7 MTG HOLE
GND MH8 MTG HOLE
MH9 MTG HOLE
MH10 MTG HOLE
MH11 MTG HOLE
PL3/DIAG
JPL3
15 ACTTR3
14 ACTTL3
13 ACTC3
12 ACTB3
11 ACTA3
10 RT3
9 LF3
8 DN3
7 UP3
6 START3
5 COIN3
4 SERVICE3
3
2 +5V
1 GND
JSYNC
1 HSYNC.OUT
2 VSYNC.OUT
3 VIDGND
JAUD
1 SNDRES
2 AUDFULL
3 AUDIRQ
4 68.AUDRD
5 68.AUDWR
6 XD15
7 XD14
8 XD13
9 XD12
10 XD11
11 XD10
12 XD9
13 XD8
14 1HBUF
15
16
17 COINL
18 GND
19 COINR
20 SELFTEST
21 TILT
22 SERVICER
23 SPKR-R
24 SPKR+R
25 SPKR-L
26 SPKR+L
27 SP1
28
29 +5V
30 +5V
31 +12V
32 +12V
33 -5V
34 -5V
35 GND
36 GND
SP2
CCNTRR
CCNTRL
1HBUF C9 1000PF C73 100PF
SPKR+R C10 1000PF
SPKR-R C8 1000PF
CCNTRL C7 .01
CCNTRR C19 .01
COINL C18 .01
COINR C5 .01
+12V C4 .01
-5V C17 .01
TILT GND
JX
GND 1
2 XA1
3 XA2
4 XA3
5 XA4
6 XA5
7 XA6
8 XA7
9 XA8
+5V 10
11 XA9
12 XA10
13 XA11
14 XA12
15
16
17
18
GND 19
20 XA17
21 XA18
22 XA19
23 68.EXT
24
+5V 25
26 XAS
GND 27
28 XD0
29 XD1
30 XD2
31 XD3
32 XD4
33 XD5
34 XD6
35 XD7
GND 36
37 XD8
38 XD9
39 XD10
40 XD11
41 XD12
42 XD13
43 XD14
44 XD15
+5V 45
46 XR/W
47 XWP
48
49 XRESET
50
+5V 51
52
53
54 XFULL
55
56 XDS
57
58
59
GND 60
R144 1K
R72 1K
R73 10K
R145 1K
+5V
MASTER
X.IRQ
BUSY
BVLOCK
R146 2.2K
GND

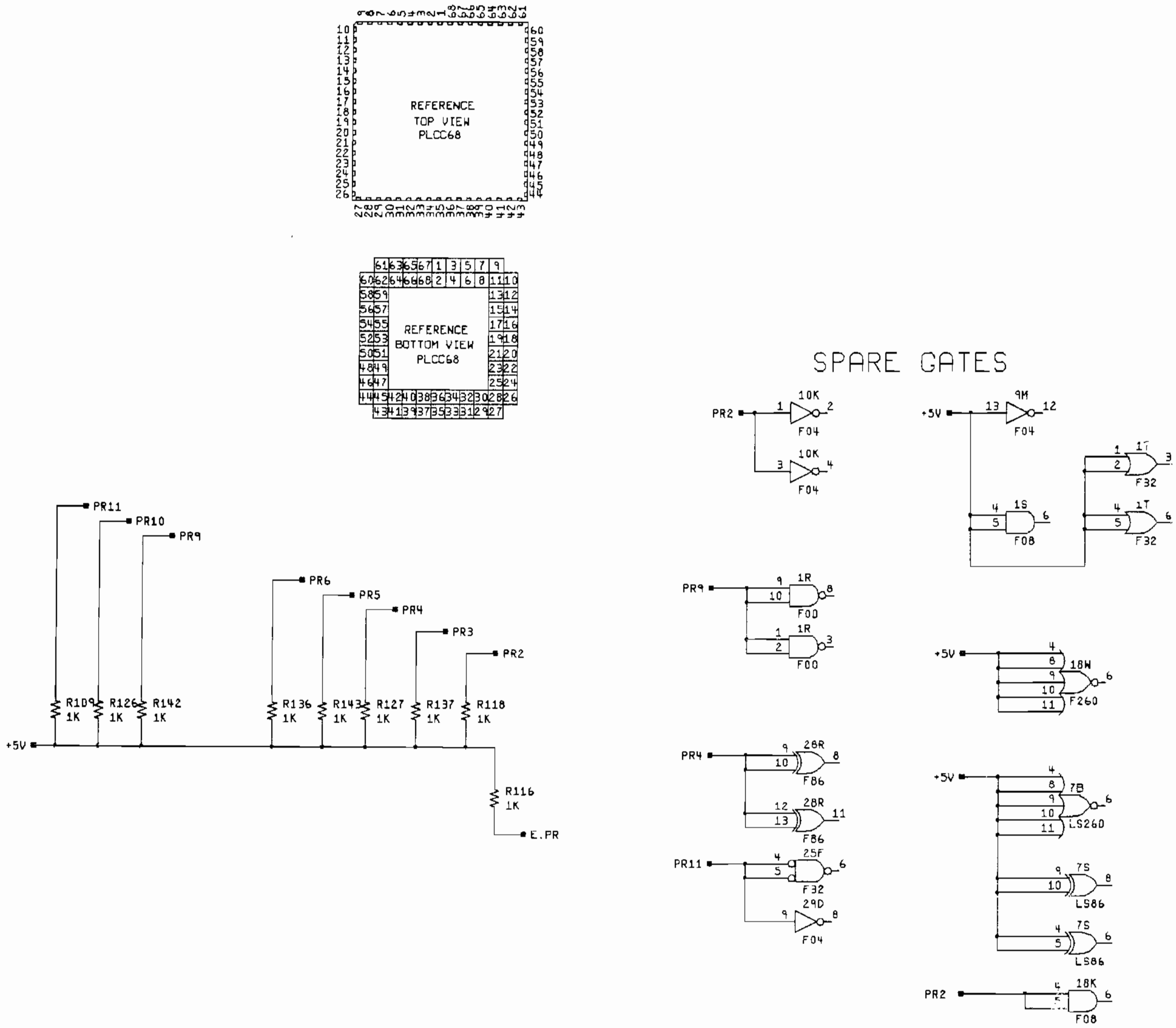
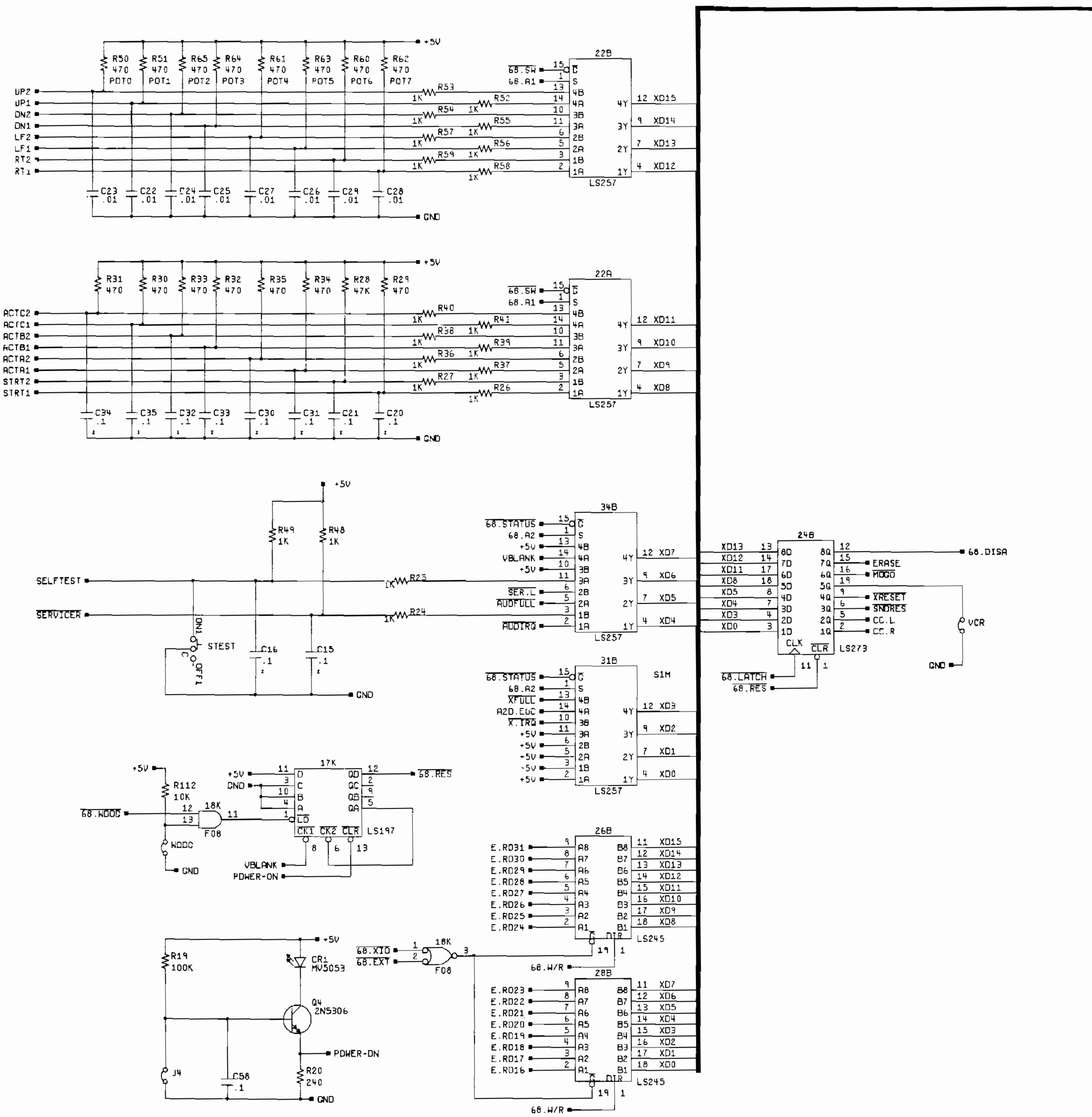


Figure 5-1 Space Lords Game PCB (GX2) Assembly Schematic Diagram

049809-XX E



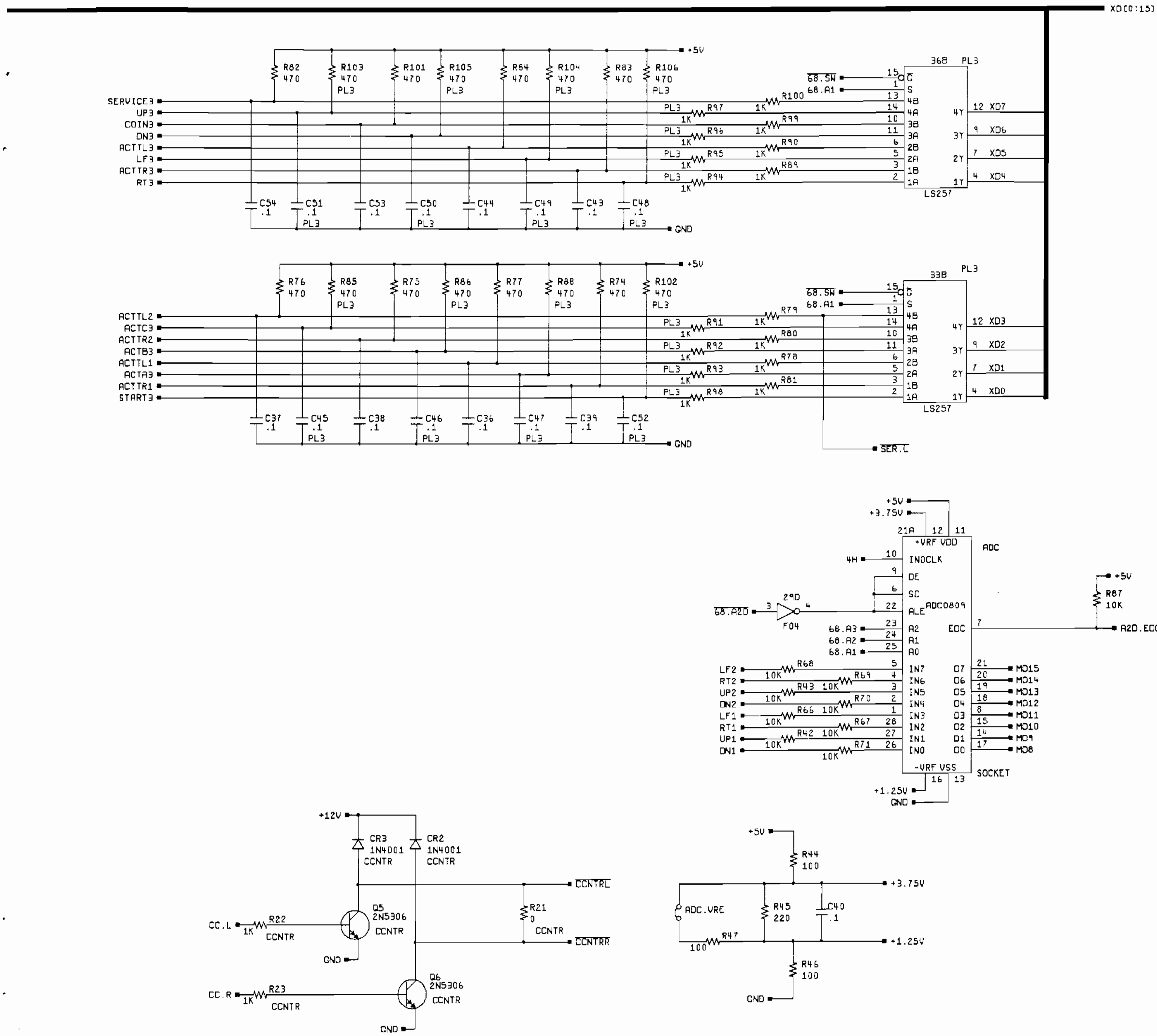
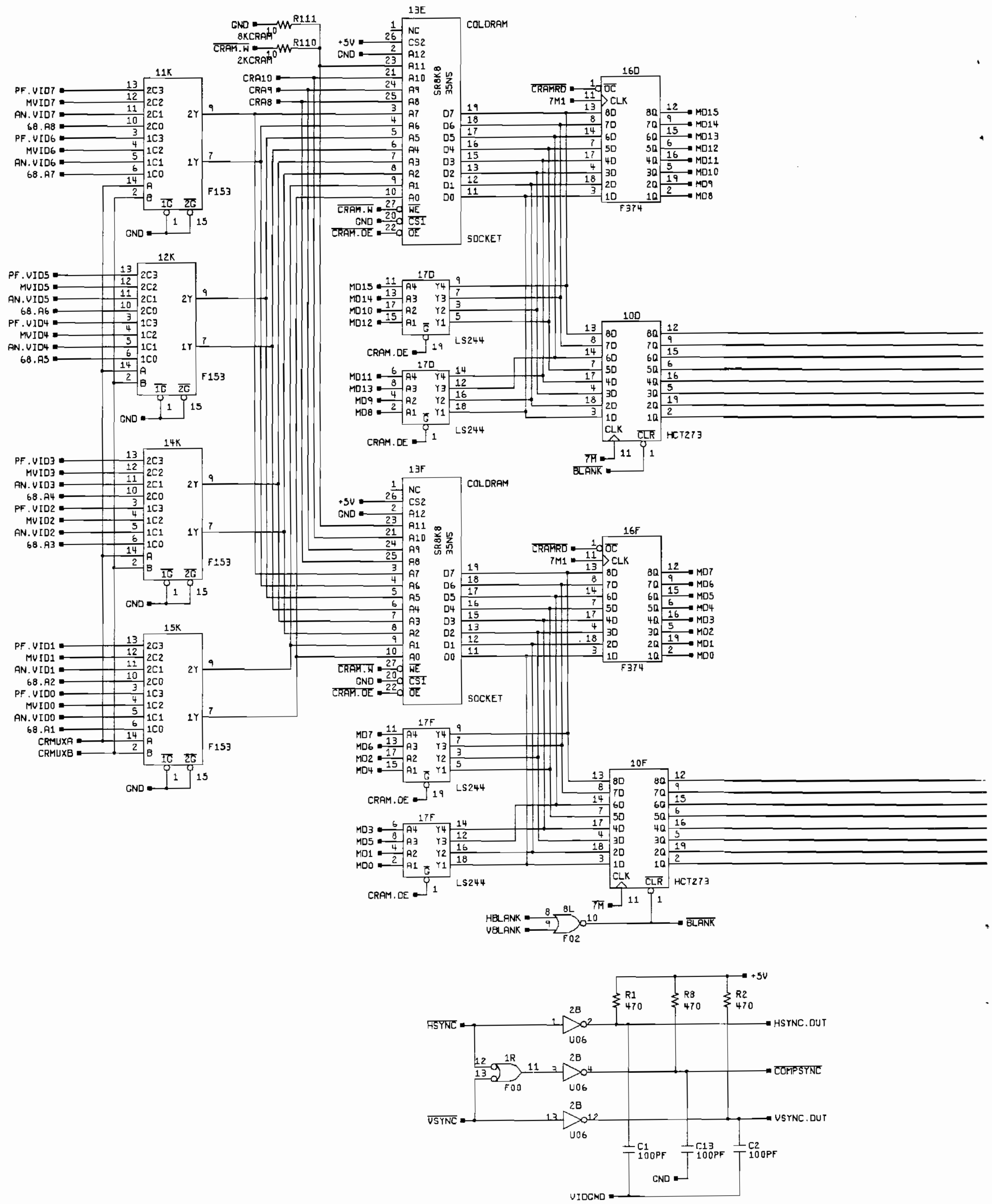


Figure 5-1 Space Lords Game PCB (GX2) Assembly Schematic Diagram

049809-XX E


13E
COLORAM
SR8K8 35NS
SOCKET
16D
F374
17D
LS244
10D
HCT273
11K
F153
12K
F153
14K
F153
15K
F153
13F
COLORAM
SR8K8 35NS
SOCKET
16F
F374
17F
LS244
10F
HCT273
8L
F02
1R
F00
2B
U06
R111
R110
GND
8KCRAM
CRAM.W
2KCRAM
+5V
CRA10
CRA9
CRA8
CRAMRD
7M1
MD15
MD14
MD13
MD12
MD11
MD10
MD9
MD8
MD7
MD6
MD5
MD4
MD3
MD2
MD1
MD0
CRAM.DE
CRAM.OE
7M
BLANK
PF.VID7
MVID7
AN.VID7
68.A8
PF.VID6
MVID6
AN.VID6
68.A7
PF.VID5
MVID5
AN.VID5
68.A6
PF.VID4
MVID4
AN.VID4
68.A5
PF.VID3
MVID3
AN.VID3
68.A4
PF.VID2
MVID2
AN.VID2
68.A3
PF.VID1
MVID1
AN.VID1
68.A2
PF.VID0
MVID0
AN.VID0
68.A1
CRMUXA
CRMUXB
HBLANK
VBLANK
HSYNC
VSYNC
HSYNC.OUT
COMPSYNC
VSYNC.OUT
R1 470
R8 470
R2 470
C1 100PF
C13 100PF
C2 100PF
VIDGND

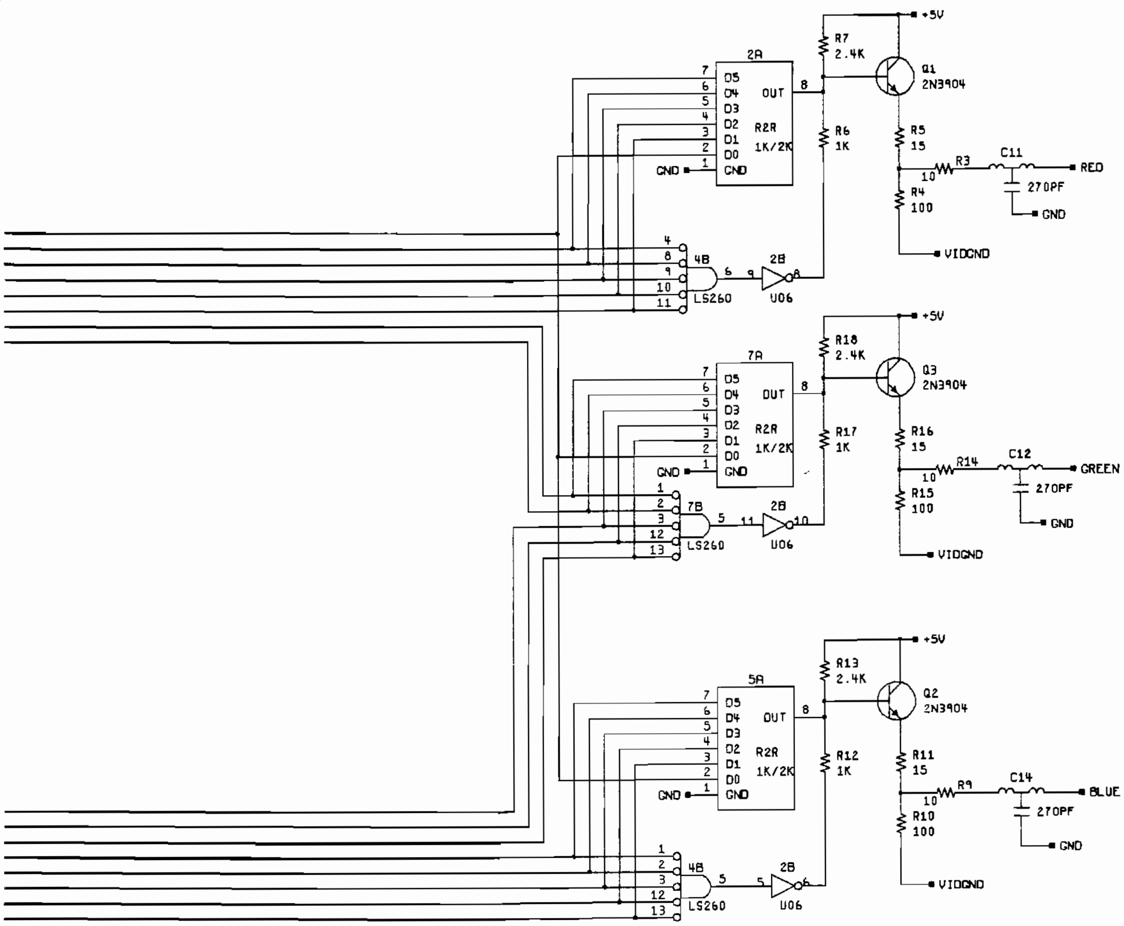
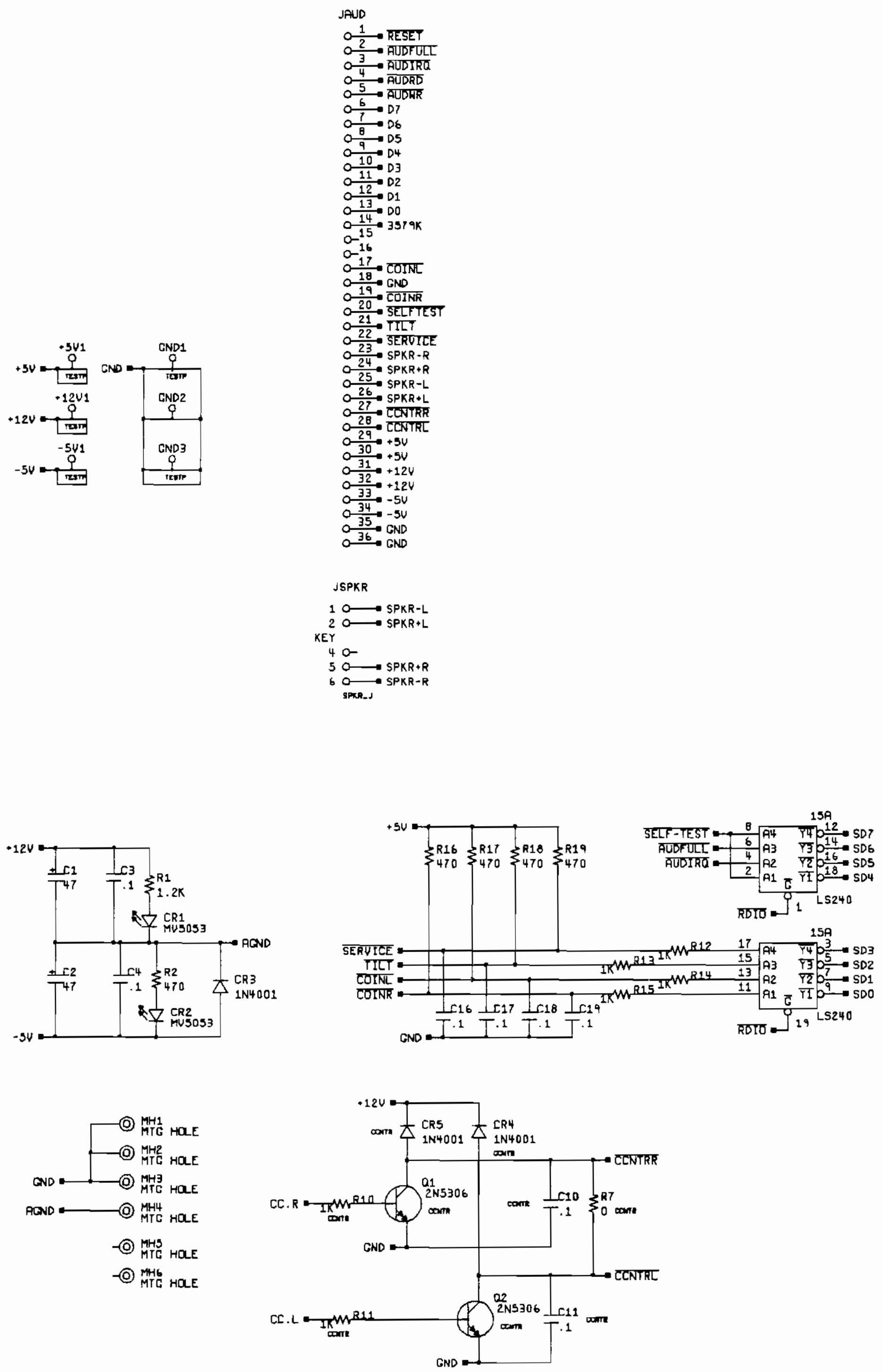


Figure 5-1 Space Lords Game PCB (GX2) Assembly Schematic Diagram

A049809-XX E



GND and AGND tied internally near MSM6295s

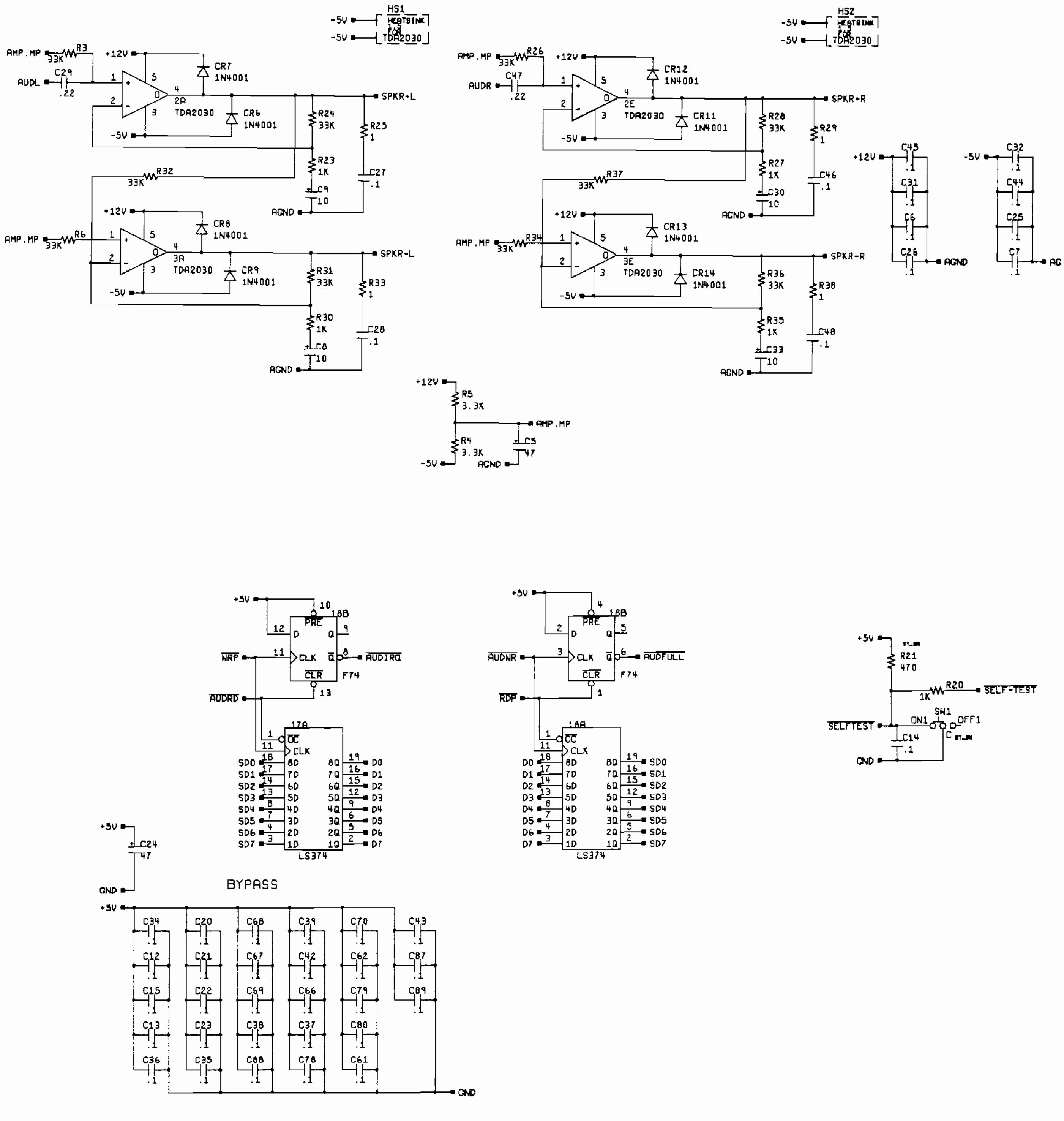
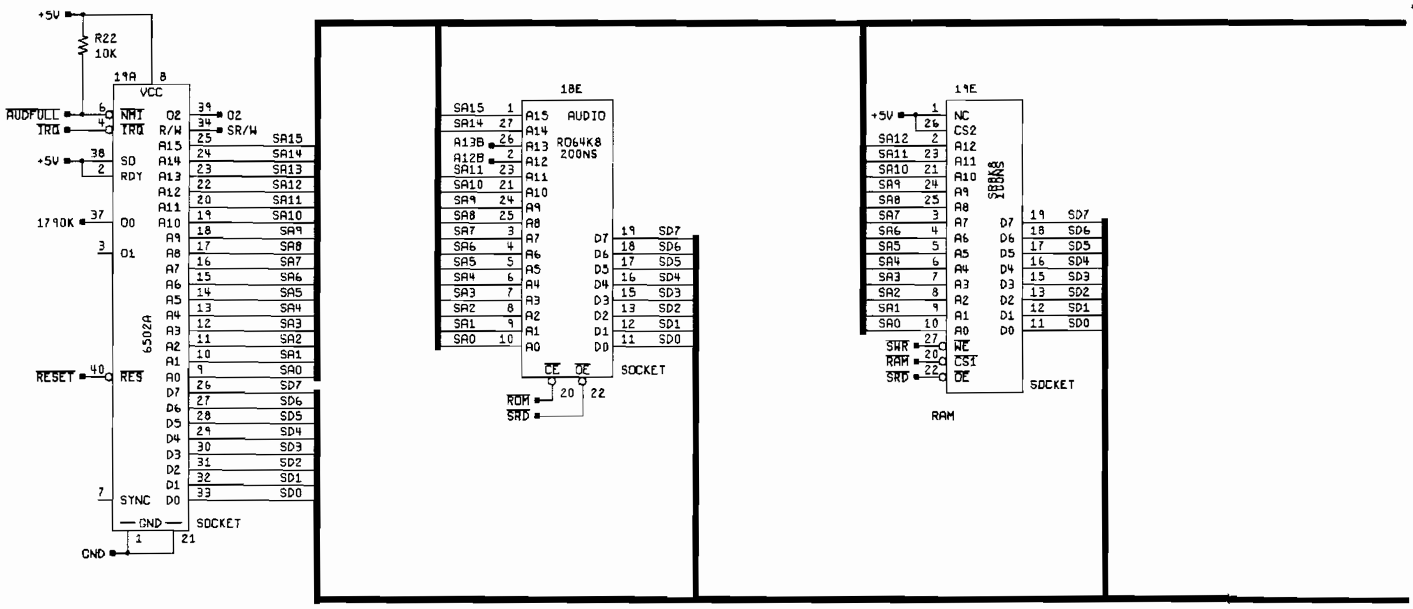
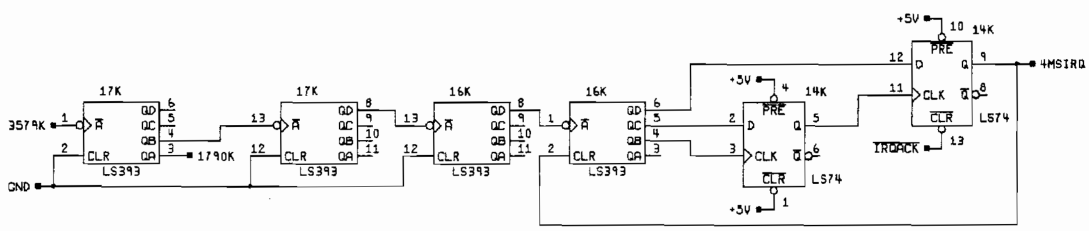


Figure 5-2 JSA3S PCB Assembly Schematic Diagram

A049953-XX A


+5V
R22
10K
19A
VCC
AUDFULL
IRQ
NMI
SO
RDY
1790K
O0
O1
RESET
RES
SYNC
GND
GND
SOCKET
6502A
O2
SR/W
18E
AUDIO
R064K8
200NS
SOCKET
ROM
SRD
19E
NC
CS2
5BBK8
SWR
RAM
SRD
WE
CS1
OE
SOCKET
RAM


3579K
GND
17K
LS393
1790K
17K
LS393
16K
LS393
16K
LS393
+5V
14K
PRE
CLK
CLR
LS74
+5V
10
14K
PRE
CLR
LS74
4MSIRQ
IRQACK

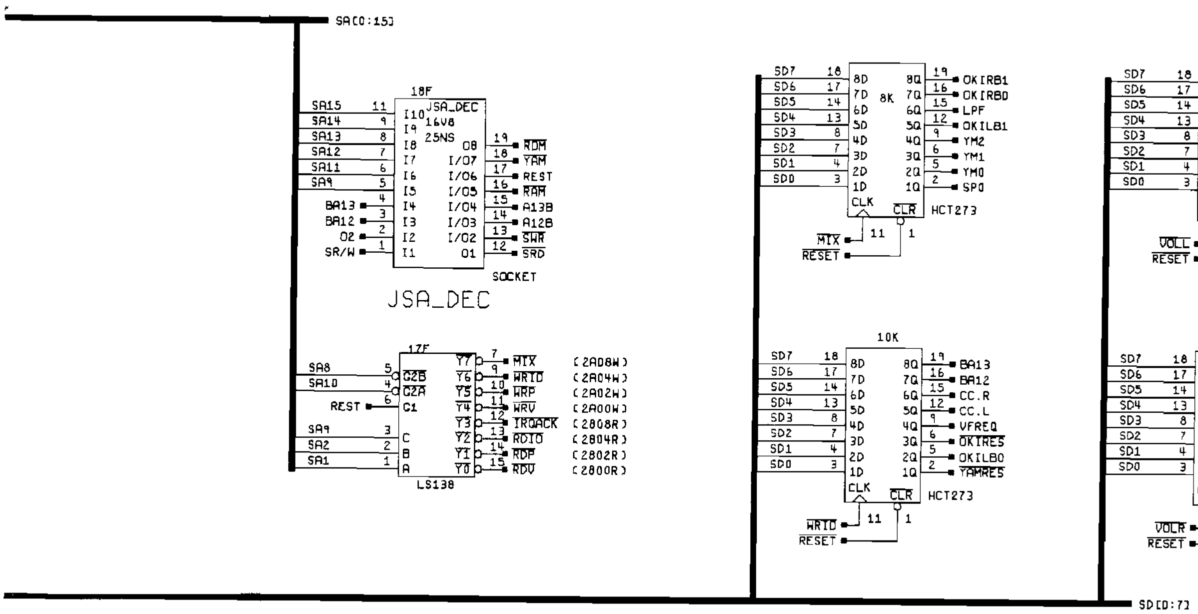
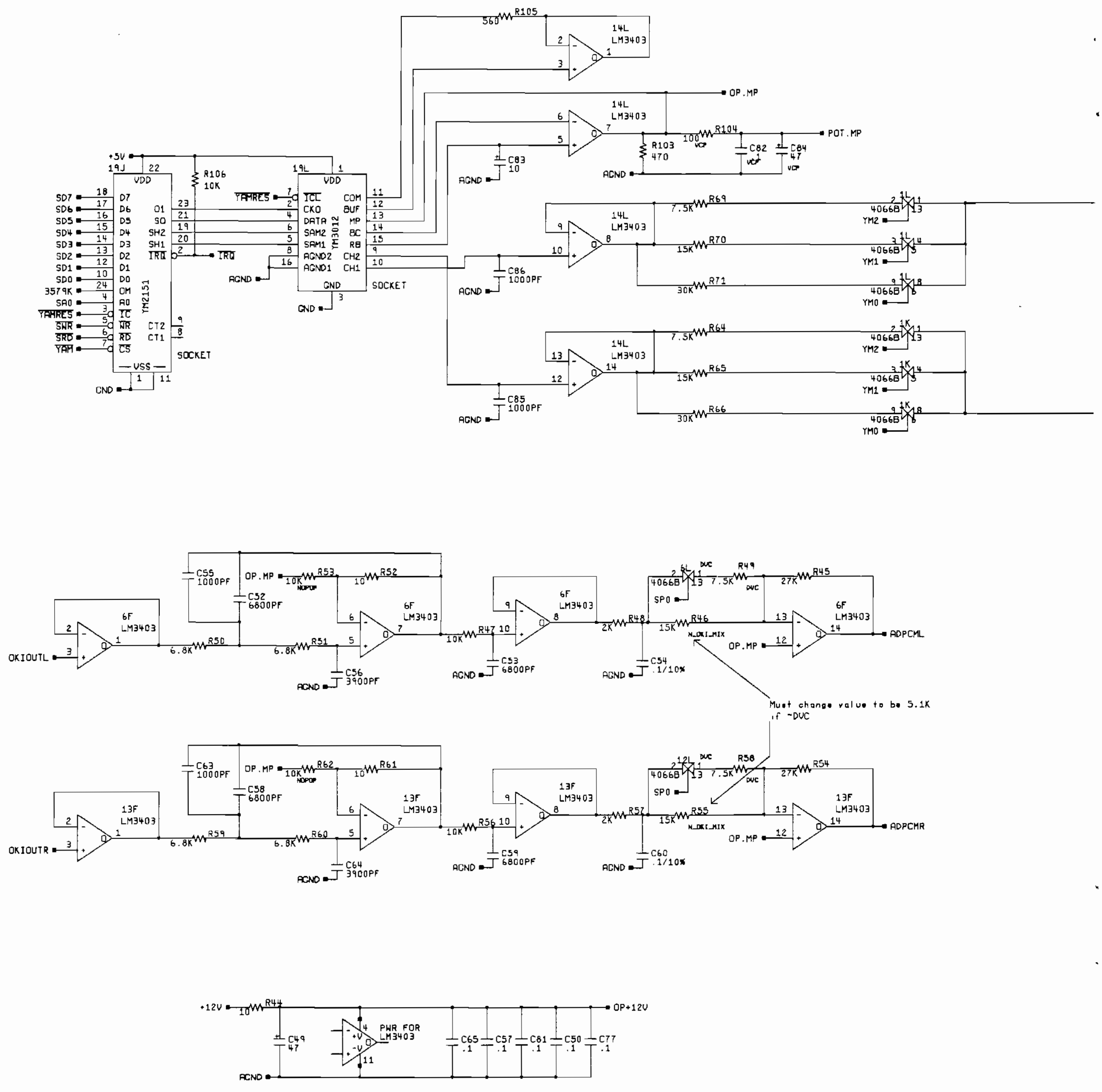


Figure 5-2 JSA3S PCB Assembly Schematic Diagram

A049953-XX A


R105
560
14L
LM3403
OP.MP
R104
POT.MP
R103
470
C82
C84
47
C83
10
AGND
+5V
19J
VDD
R106
10K
19L
YAMRES
ICL
CKO
DATA
SAM2
SAM1
AGND2
AGND1
COM
BUF
MP
BC
RB
CH2
CH1
YM3012
GND
SOCKET
SD7
SD6
SD5
SD4
SD3
SD2
SD1
SD0
3579K
SA0
SWR
SRD
YAM
D7
D6
D5
D4
D3
D2
D1
D0
CM
A0
IC
WR
RD
CS
O1
SO
SH2
SH1
IRQ
CT2
CT1
YM2151
VSS
C86
1000PF
C85
1000PF
R69
7.5K
R70
15K
R71
30K
R64
R65
R66
4066B
YM2
YM1
YM0
C55
1000PF
C52
6800PF
R53
R52
10K
NOPOP
6F
LM3403
OKIOUTL
R50
6.8K
R51
C56
3900PF
R47
C53
6800PF
R48
2K
R46
N_OKI_MIX
C54
.1/10%
6L
DVC
R49
R45
27K
SP0
ADPCML
Must change value to be 5.1K
if ~DVC
C63
C58
R62
R61
13F
OKIOUTR
R59
R60
C64
R56
C59
R57
R55
C60
12L
R58
R54
ADPCMR
+12V
R44
C49
PWR FOR
LM3403
C65
C57
C61
C50
C77
OP+12V

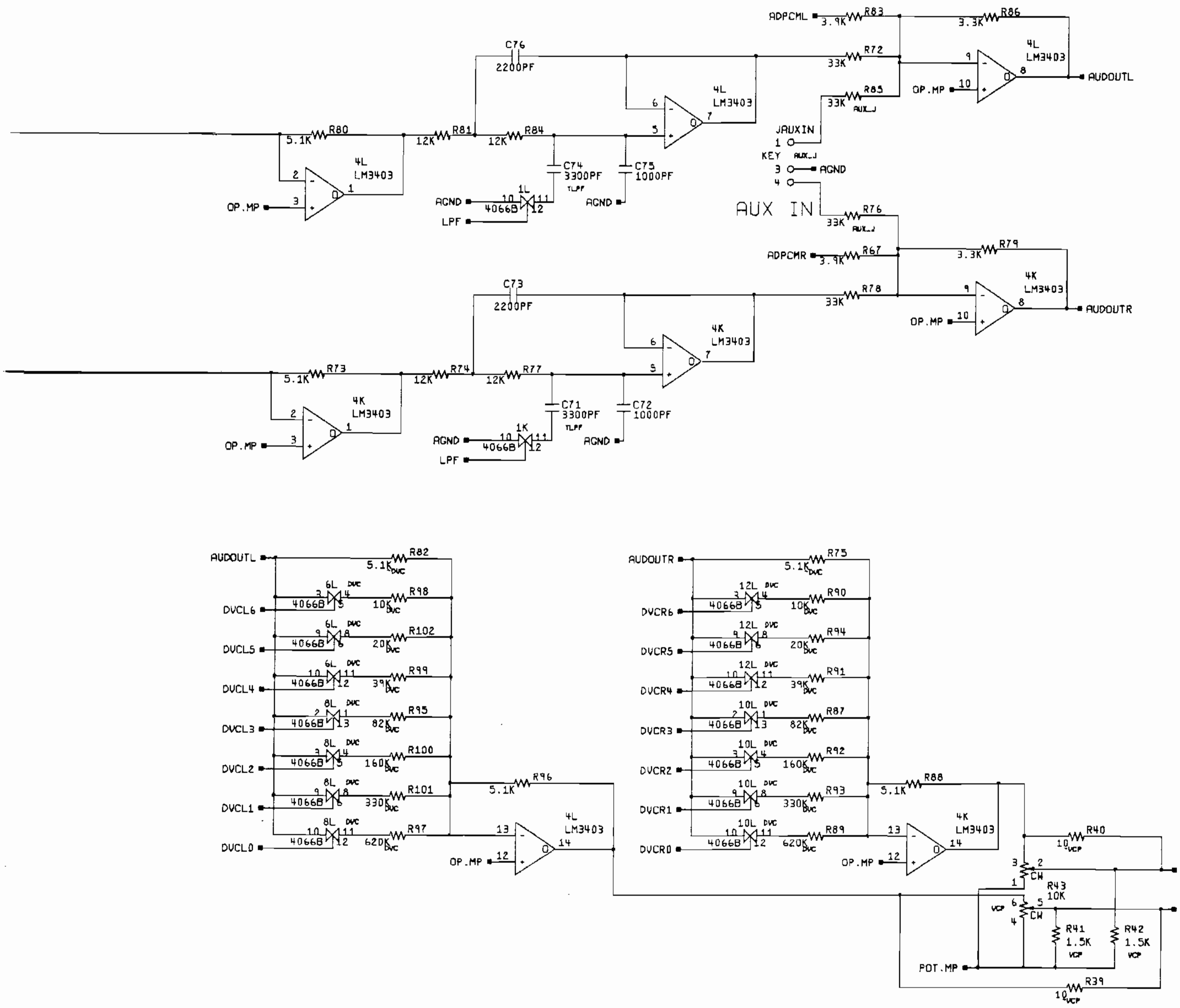
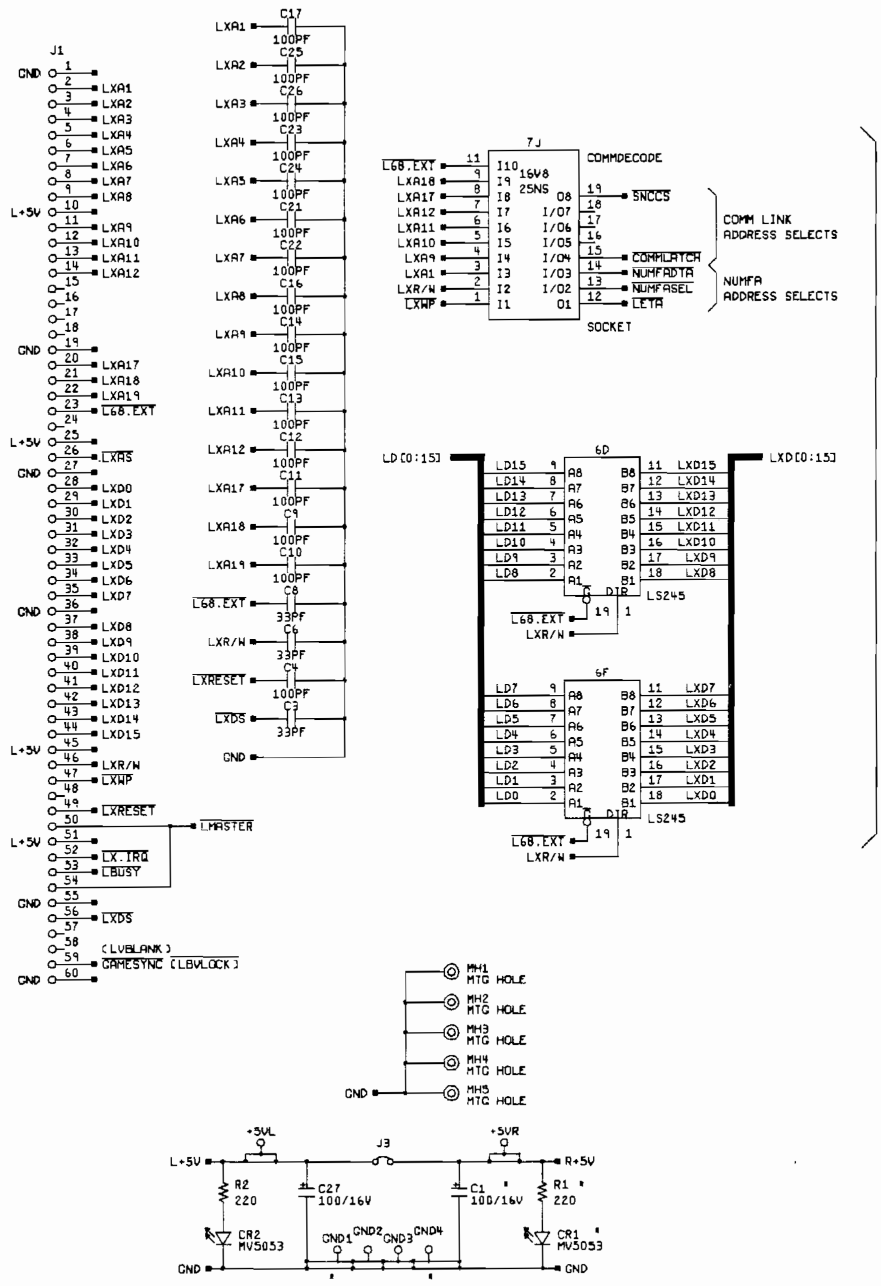


Figure 5-2 JSA3S PCB Assembly Schematic Diagram

A049953-XX A


J1
COMMDECODE
16V8
25NS
SOCKET
COMM LINK
ADDRESS SELECTS
NUMFA
ADDRESS SELECTS
LD[0:15]
LXD[0:15]
LS245
Vcc = L+5V
MTG HOLE
J3
MV5053

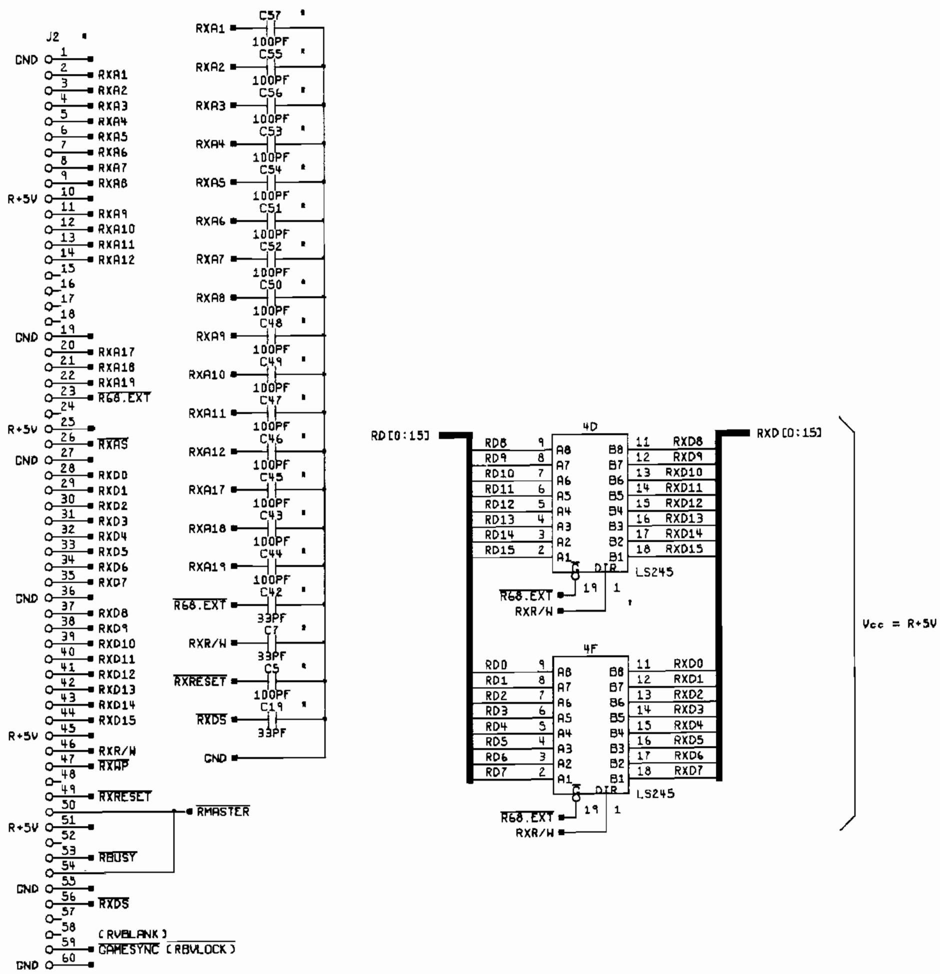
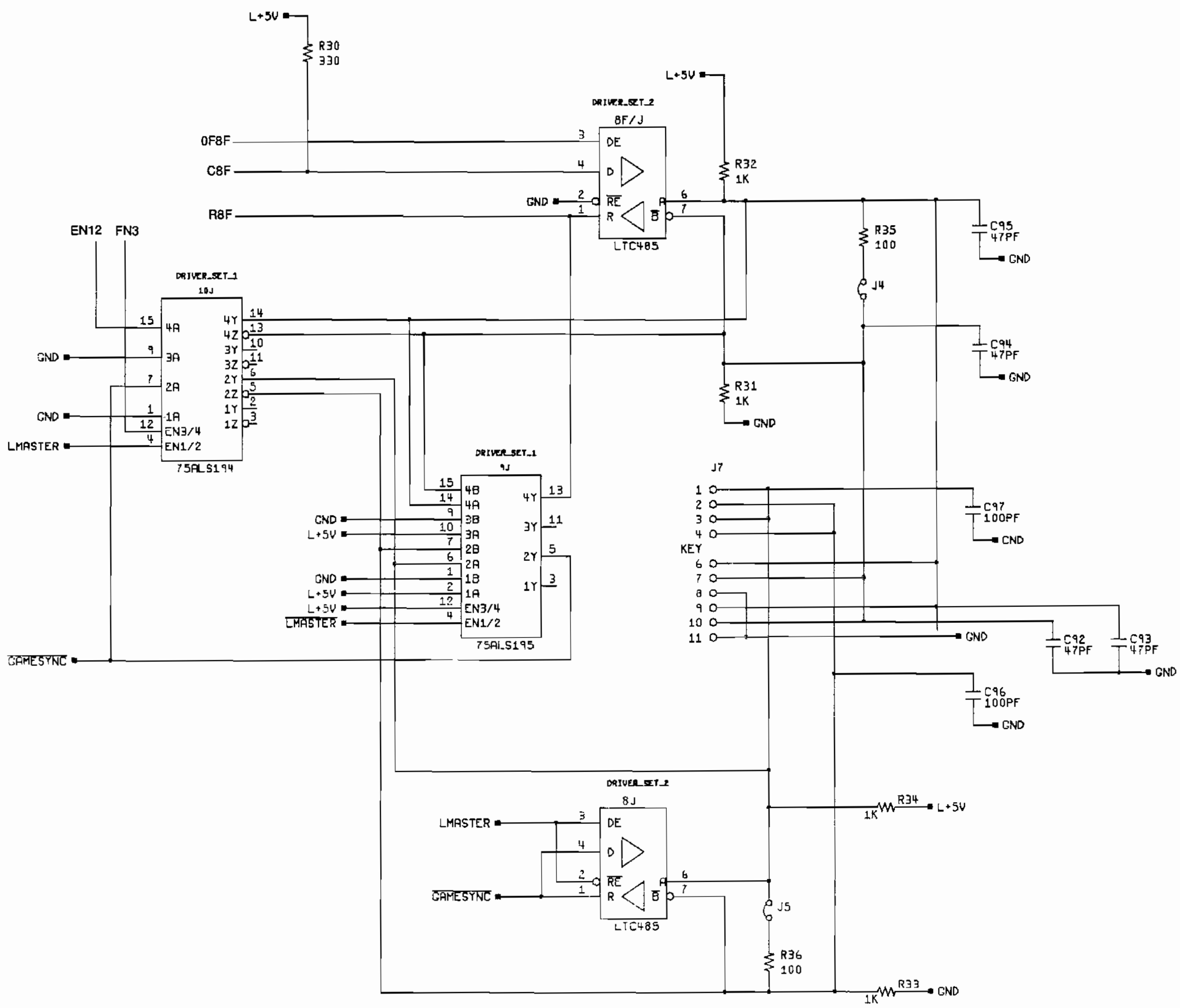
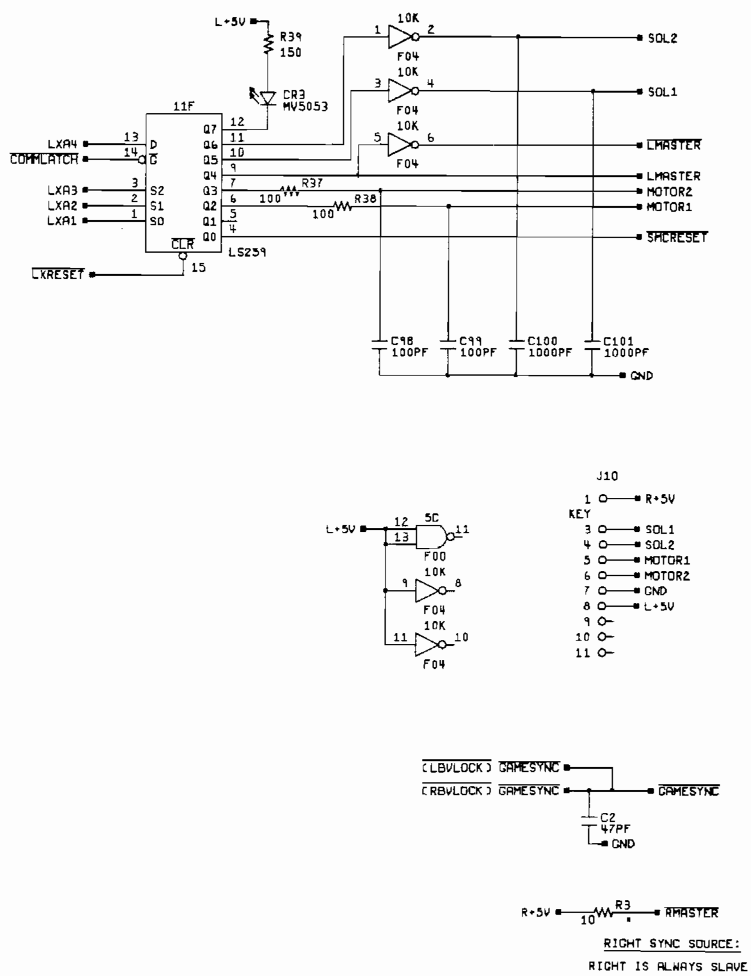


Figure 5-3 CLARN II PCB Assembly Schematic Diagram

A051092-XX D

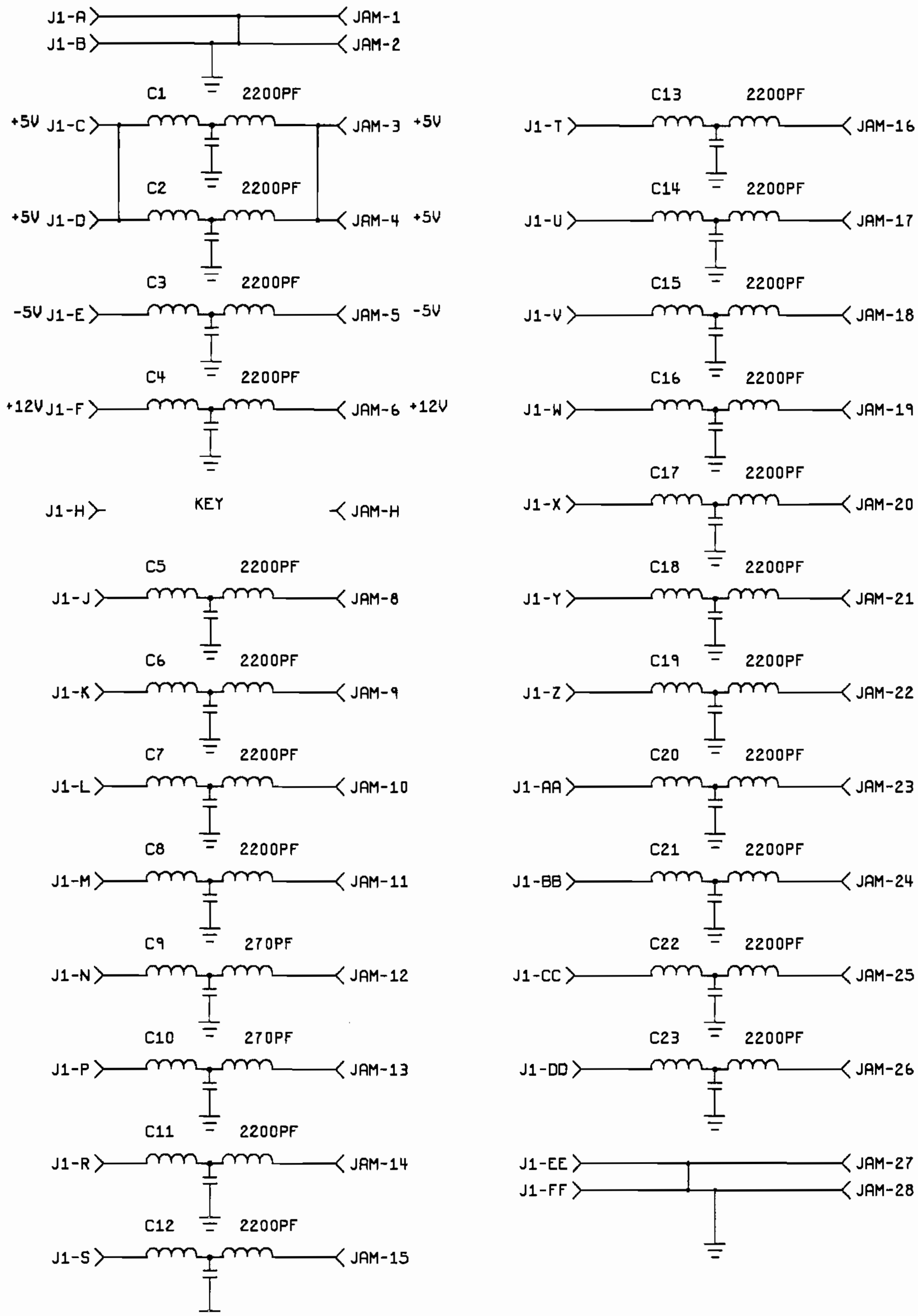

L+5V
R30
330
L+5V
DRIVER_SET_2
8F/J
0F8F
C8F
R8F
DE
D
RE
R
B
LTC485
R32
1K
GND
R35
100
C95
47PF
GND
J4
C94
47PF
GND
EN12
FN3
DRIVER_SET_1
10J
4A
3A
2A
1A
EN3/4
EN1/2
4Y
4Z
3Y
3Z
2Y
2Z
1Y
1Z
75ALS194
GND
GND
LMASTER
R31
1K
GND
DRIVER_SET_1
9J
4B
4A
3B
3A
2B
2A
1B
1A
EN3/4
EN1/2
4Y
3Y
2Y
1Y
75ALS195
GND
L+5V
GND
L+5V
L+5V
LMASTER
GAMESYNC
J7
KEY
C97
100PF
GND
GND
C92
47PF
C93
47PF
GND
C96
100PF
GND
DRIVER_SET_2
8J
LMASTER
GAMESYNC
DE
D
RE
R
B
LTC485
R34
1K
L+5V
J5
R36
100
R33
1K
GND



COMM LINK

Figure 5-3 CLARN II PCB Assembly Schematic Diagram

A051092-XX D


J1-A
J1-B
JAM-1
JAM-2
C1
2200PF
+5V J1-C
JAM-3 +5V
C2
2200PF
+5V J1-D
JAM-4 +5V
C3
2200PF
-5V J1-E
JAM-5 -5V
C4
2200PF
+12V J1-F
JAM-6 +12V
J1-H
KEY
JAM-H
C5
2200PF
J1-J
JAM-8
C6
2200PF
J1-K
JAM-9
C7
2200PF
J1-L
JAM-10
C8
2200PF
J1-M
JAM-11
C9
270PF
J1-N
JAM-12
C10
270PF
J1-P
JAM-13
C11
2200PF
J1-R
JAM-14
C12
2200PF
J1-S
JAM-15
C13
2200PF
J1-T
JAM-16
C14
2200PF
J1-U
JAM-17
C15
2200PF
J1-V
JAM-18
C16
2200PF
J1-W
JAM-19
C17
2200PF
J1-X
JAM-20
C18
2200PF
J1-Y
JAM-21
C19
2200PF
J1-Z
JAM-22
C20
2200PF
J1-AA
JAM-23
C21
2200PF
J1-BB
JAM-24
C22
2200PF
J1-CC
JAM-25
C23
2200PF
J1-DD
JAM-26
J1-EE
J1-FF
JAM-27
JAM-28

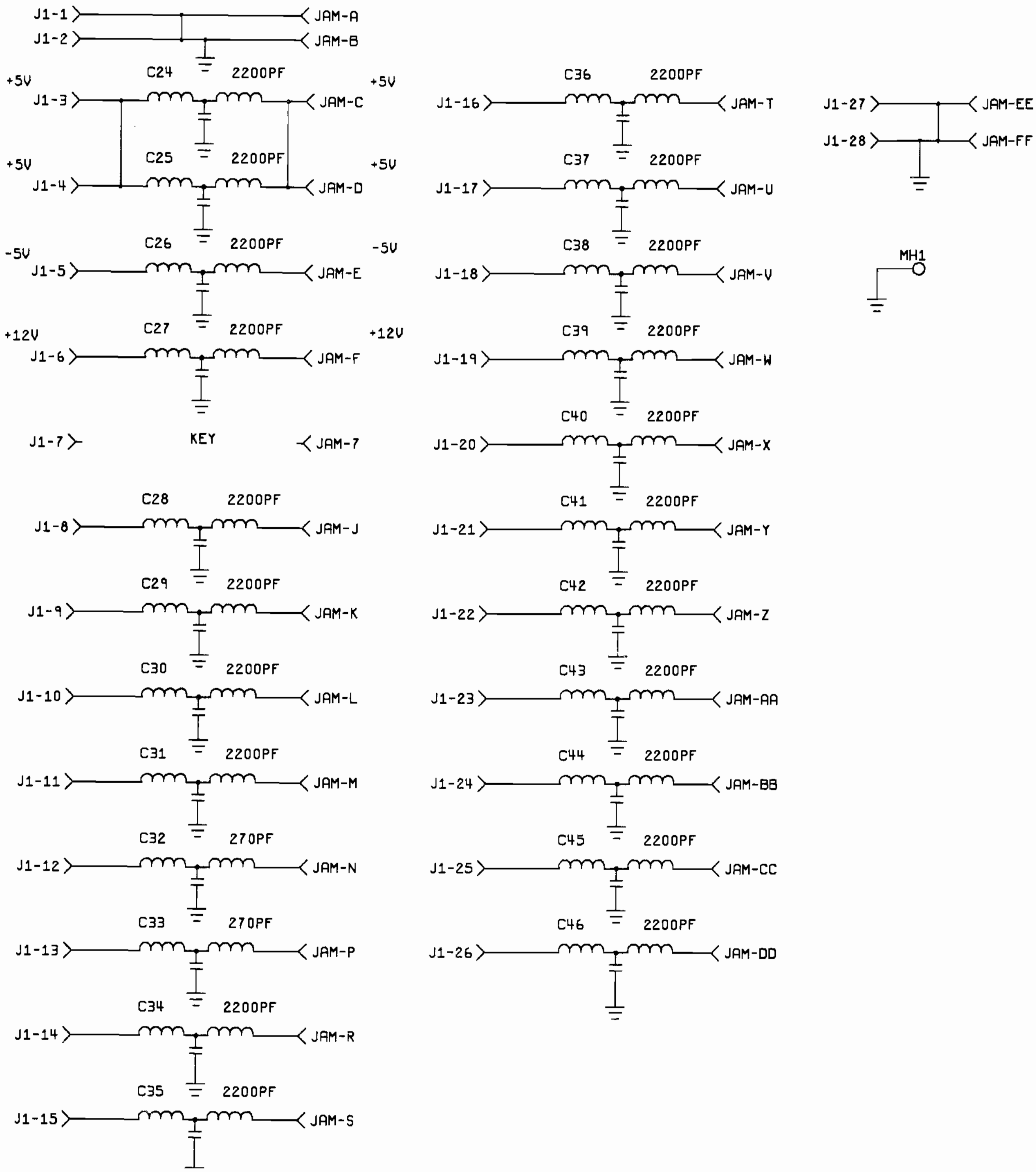
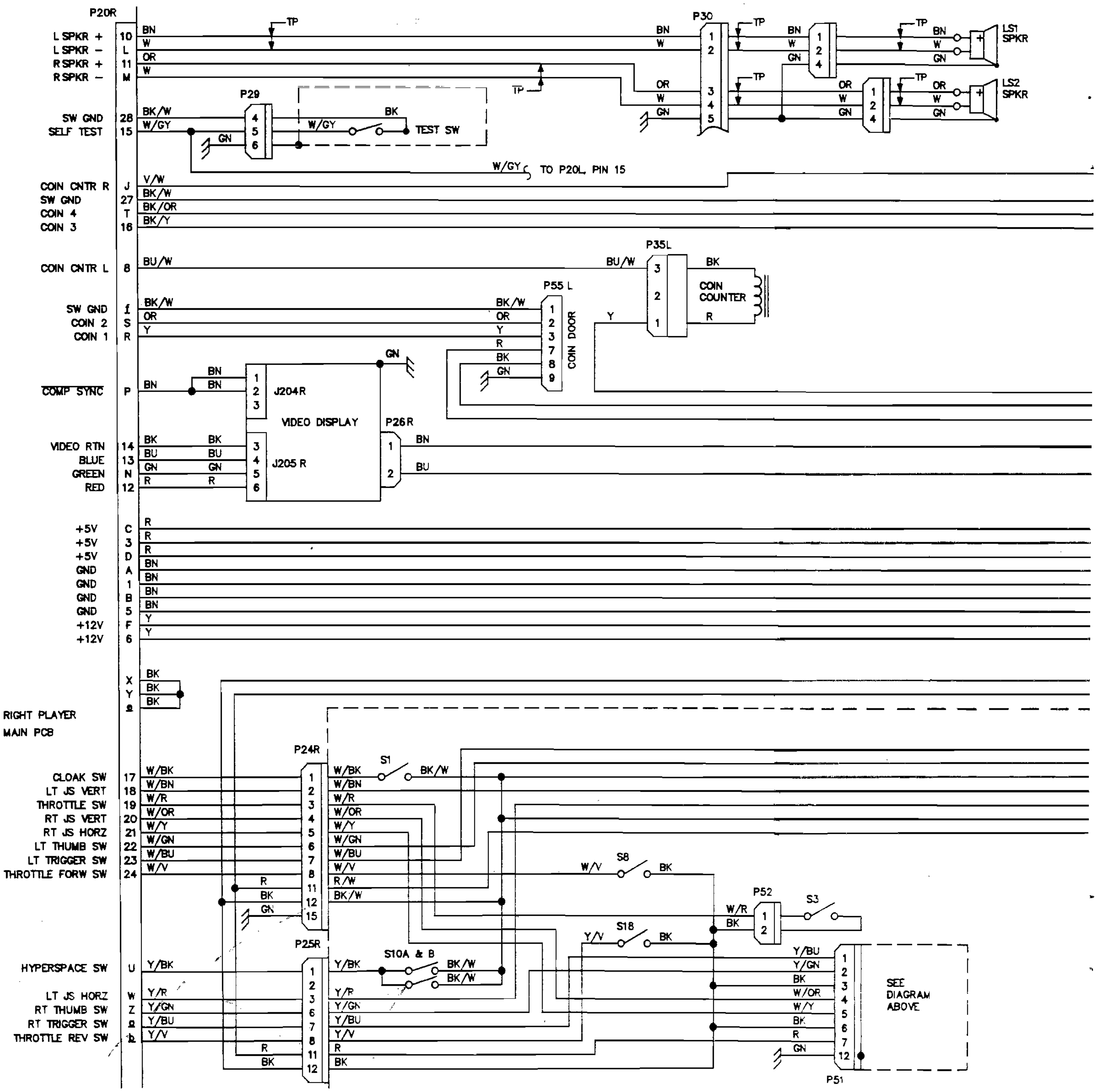


Figure 5-4 JAMMA Filter PCB Assembly Schematic Diagram

047292-02 A


P20R
L SPKR +
L SPKR –
R SPKR +
R SPKR –
SW GND
SELF TEST
COIN CNTR R
SW GND
COIN 4
COIN 3
COIN CNTR L
SW GND
COIN 2
COIN 1
COMP SYNC
VIDEO RTN
BLUE
GREEN
RED
+5V
+5V
+5V
GND
GND
GND
GND
+12V
+12V
RIGHT PLAYER
MAIN PCB
CLOAK SW
LT JS VERT
THROTTLE SW
RT JS VERT
RT JS HORZ
LT THUMB SW
LT TRIGGER SW
THROTTLE FORW SW
HYPERSPACE SW
LT JS HORZ
RT THUMB SW
RT TRIGGER SW
THROTTLE REV SW
TP
P29
TEST SW
P30
LS1
SPKR
LS2
SPKR
TO P20L, PIN 15
P35L
COIN
COUNTER
P55 L
COIN DOOR
J204R
VIDEO DISPLAY
J205 R
P26R
P24R
S1
S8
S18
P52
S3
P25R
S10A & B
SEE
DIAGRAM
ABOVE
P51

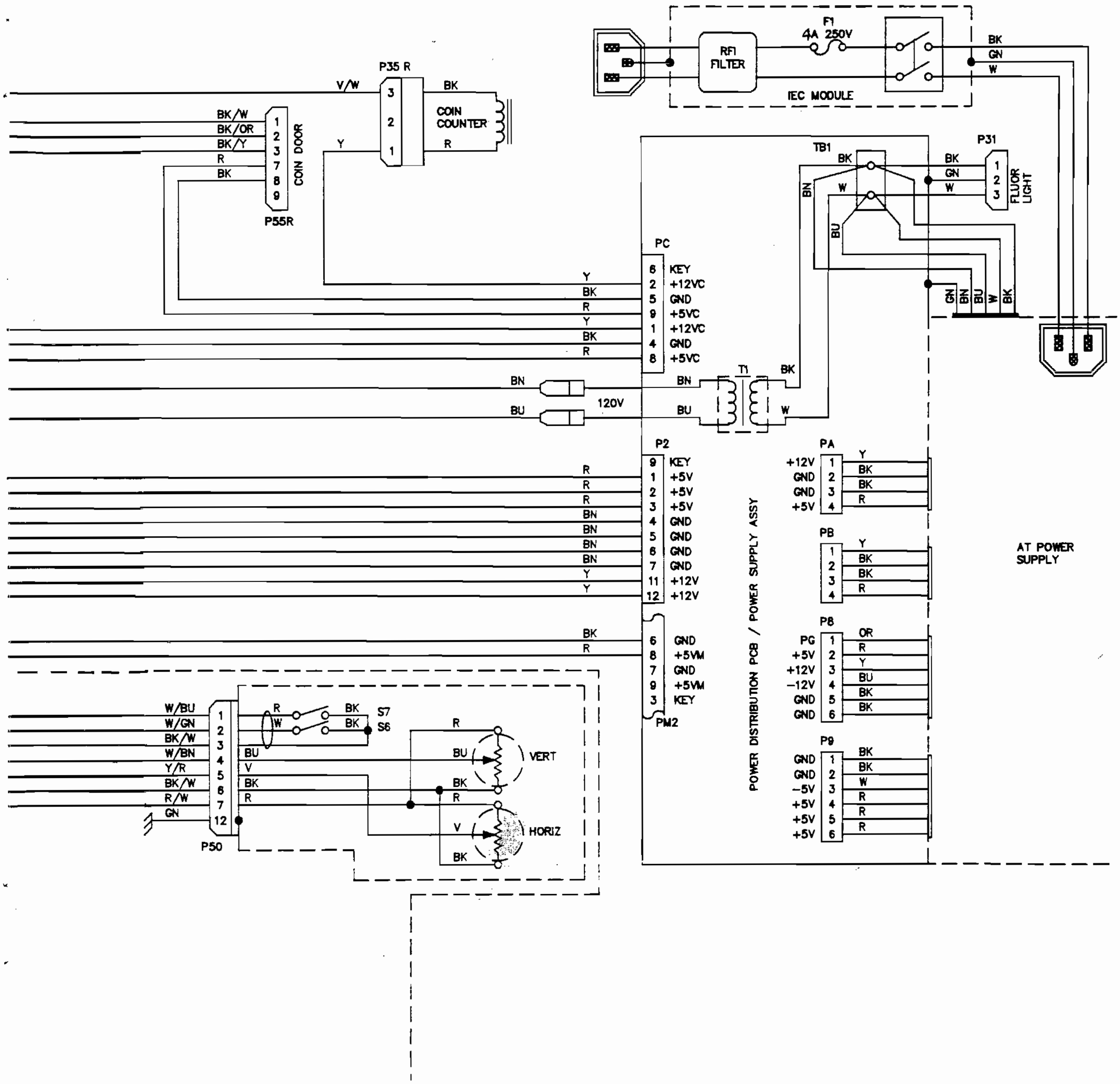
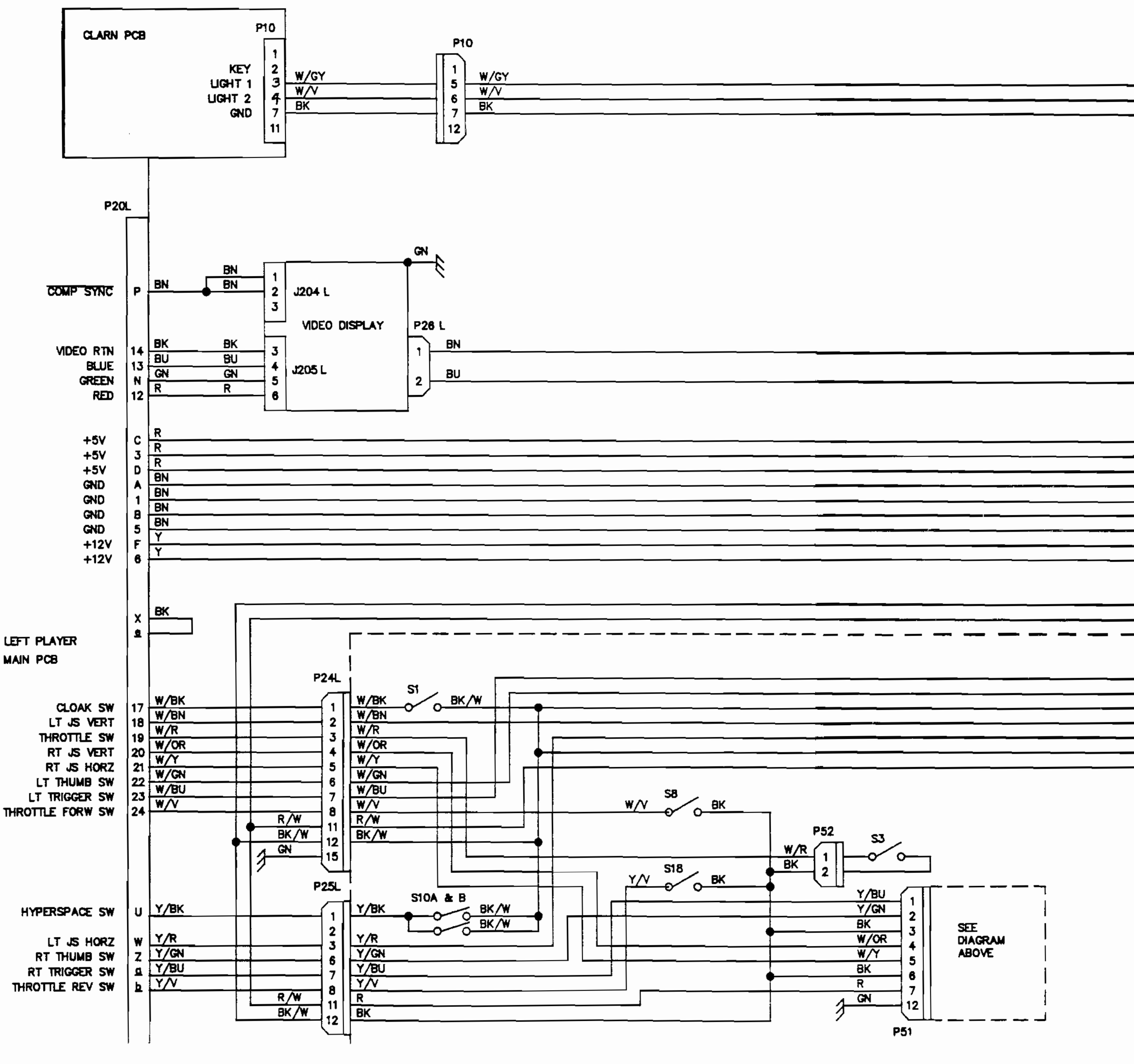


Figure 5-5 Space Lords Game Wiring Diagram

050670-01 C


CLARN PCB
P10
KEY
LIGHT 1
LIGHT 2
GND
W/GY
W/V
BK
P20L
COMP SYNC
J204 L
VIDEO DISPLAY
J205 L
P26 L
GN
BN
BU
VIDEO RTN
BLUE
GREEN
RED
+5V
GND
+12V
LEFT PLAYER
MAIN PCB
CLOAK SW
LT JS VERT
THROTTLE SW
RT JS VERT
RT JS HORZ
LT THUMB SW
LT TRIGGER SW
THROTTLE FORW SW
P24L
S1
S8
S18
S3
P52
S10A & B
P25L
HYPERSPACE SW
LT JS HORZ
RT THUMB SW
RT TRIGGER SW
THROTTLE REV SW
SEE DIAGRAM ABOVE
P51

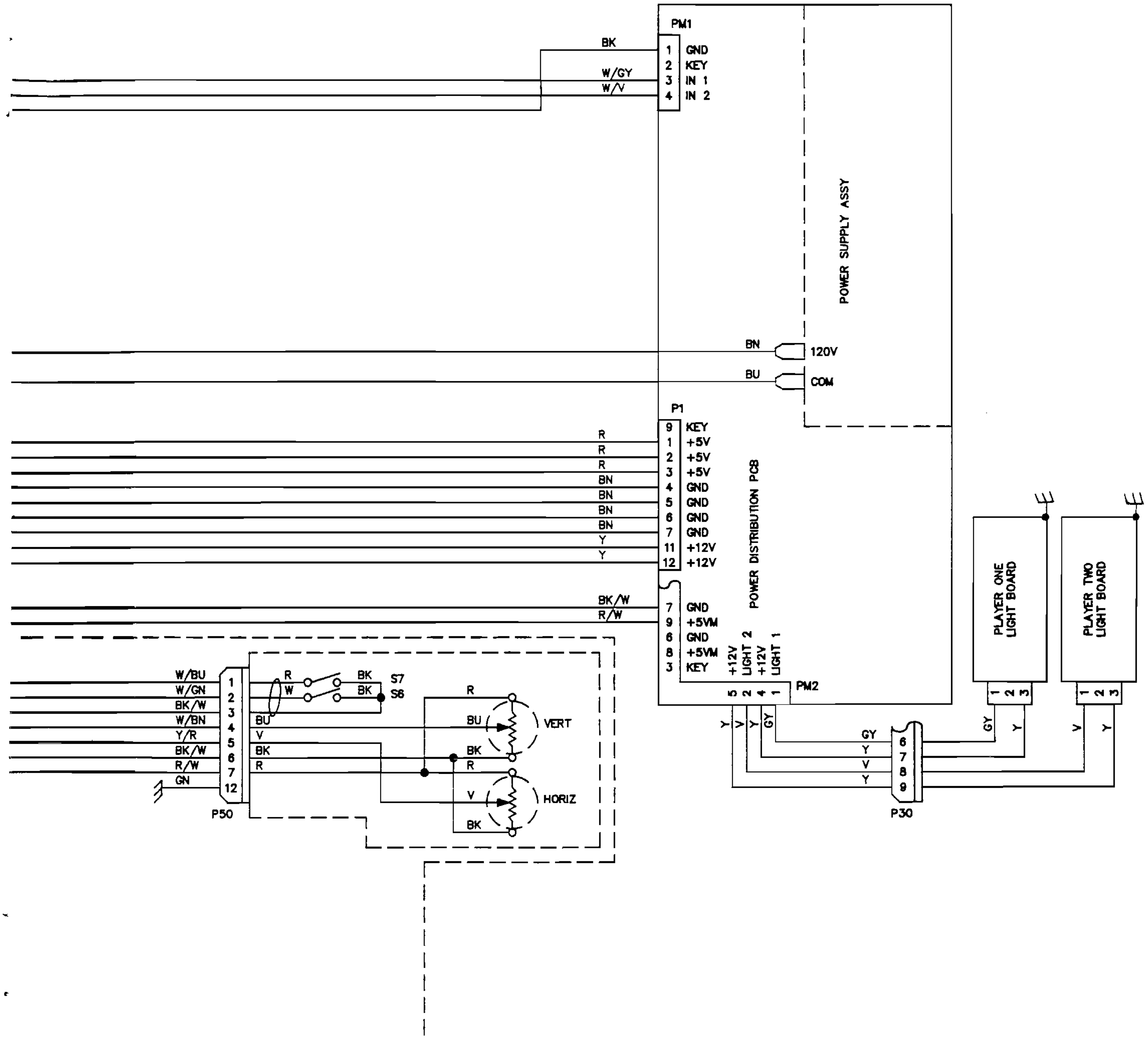


Figure 5-5 Space Lords Game Wiring Diagram

050670-01 C

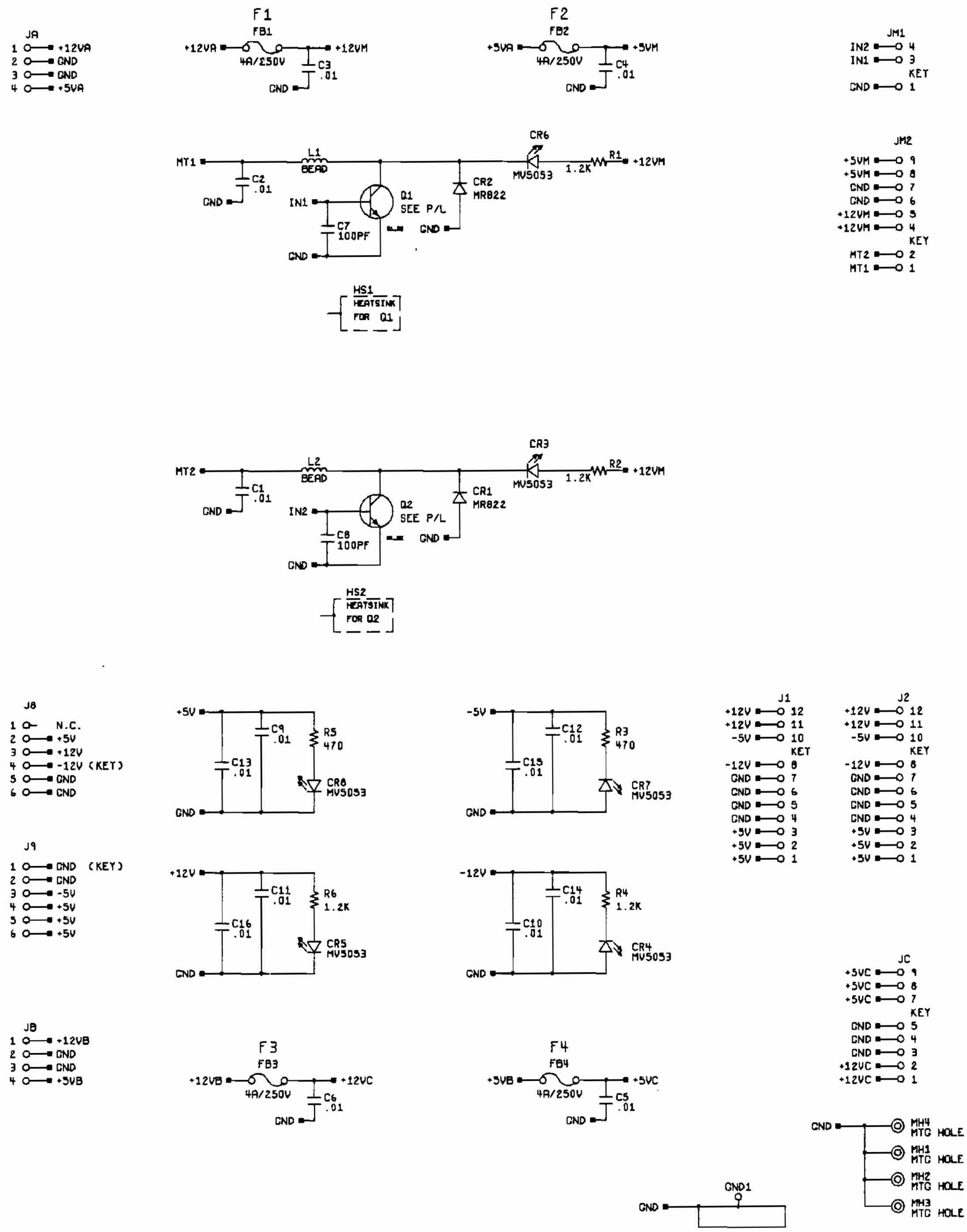


Figure 5-6 Power Distribution PCB Assembly

A050824-01 B

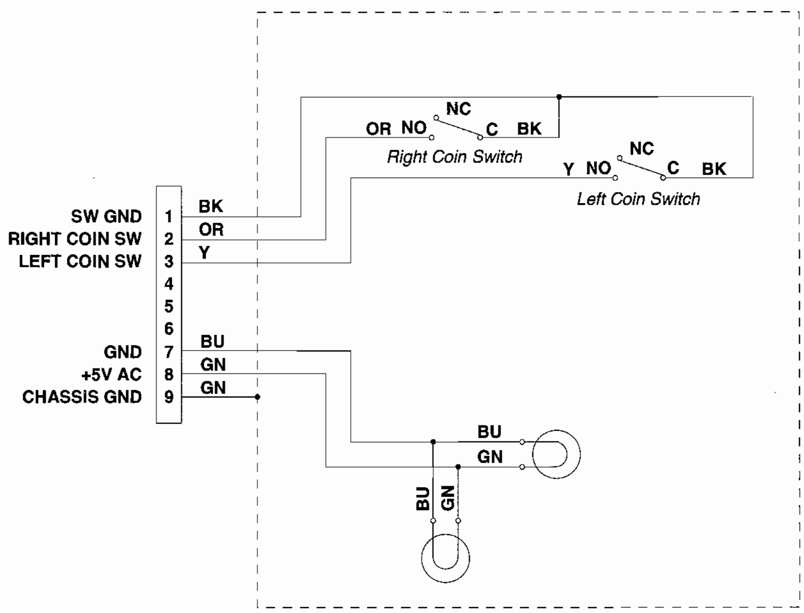


Figure 5-7 Coin Door Wiring Diagram

A037542-XX F

NOTES

Space Lords™ Statistics Sheet

ATARI GAMES

Location: ______________________ Date Recorded: ______________

Meter: ____________

STATISTICS SCREEN

Left Coins:	______	Melee Minutes:	______	Total Coins:	______
Right Coins:	______	Pilot Coins:	______	Average Time/Credit:	___ : ___
Idle Minutes:	______	Copilot Coins:	______	Percentage Play:	______ %
1-Player Minutes:	______	New Games:	______		
2-Player Minutes:	______	Continued Games:	______		
Solo Minutes:	______	Error Count:	______		
Team Minutes:	______				

SYSTEM ERROR COUNTS

Watch Dog Resets:	______	Divide By Zero:	______	Privilege Violation:	______
Address Errors:	______	Chk Instruction:	______	A to D Timeouts:	______
Illegal Instruction:	______	Trap V Instruction:	______		

Continued on back page ⇨

Space Lords™ Statistics Sheet

(Continued)

HISTOGRAM SCREENS

Time Per Life for Solo (Secs.)		*Time Per Life for Team (Secs.)*		*Time Per Life for Melee (Secs.)*	
0–19	______	0–19	______	0–29	______
20–29	______	20–29	______	30–59	______
30–39	______	30–39	______	60–89	______
40–49	______	40–49	______	90–119	______
50–59	______	50–59	______	120–149	______
60–69	______	60–69	______	150–179	______
70–79	______	70–79	______	180–209	______
80–89	______	80–89	______	210–239	______
90–99	______	90–99	______	240–269	______
100–109	______	100–109	______	270–299	______
110–119	______	110–119	______	300–329	______
120–129	______	120–129	______	330–359	______
130–139	______	130–139	______	360–389	______
140–149	______	140–149	______	390–419	______
150–159	______	150–159	______	420–449	______
160–169	______	160–169	______	450–479	______
170–179	______	170–179	______	480–509	______
180–189	______	180–189	______	510–539	______
190–199	______	190–199	______	540–569	______
200 & up	______	200 & up	______	570 & up	______
Total	______	Total	______	Total	______
Median	______	Median	______	Median	______

HISTOGRAM SCREENS, CONT.

Session Times (Minutes)					
0–1	______	10–11	______	30–31	______
2–3	______	12–13	______	32–33	______
4–5	______	14–15	______	34–35	______
6–7	______	16–17	______	36–37	______
8–9	______	18–19	______	38 & up	______
		20–21	______	Total	______
		22–23	______	Median	______
		24–25	______		
		26–27	______		
		28–29	______		

Warranty

Seller warrants that its printed-circuit boards and parts thereon are free from defects in material and workmanship under normal use and service for a period of ninety (90) days from date of shipment. Seller warrants that its video displays and laser-video disc players (in games supplied with displays and video-disc players) are free from defects in material and workmanship under normal use and service for a period of thirty (30) days from date of shipment. None of the Seller's other products or parts thereof are warranted.

If the products described in this manual fail to conform to this warranty, Seller's sole liability shall be, at its option, to repair, replace, or credit Buyer's account for such products which are returned to Seller during said warranty period, provided:

(a) Seller is promptly notified in writing upon discovery by Buyer that said products are defective;

(b) Such products are returned prepaid to Seller's plant; and

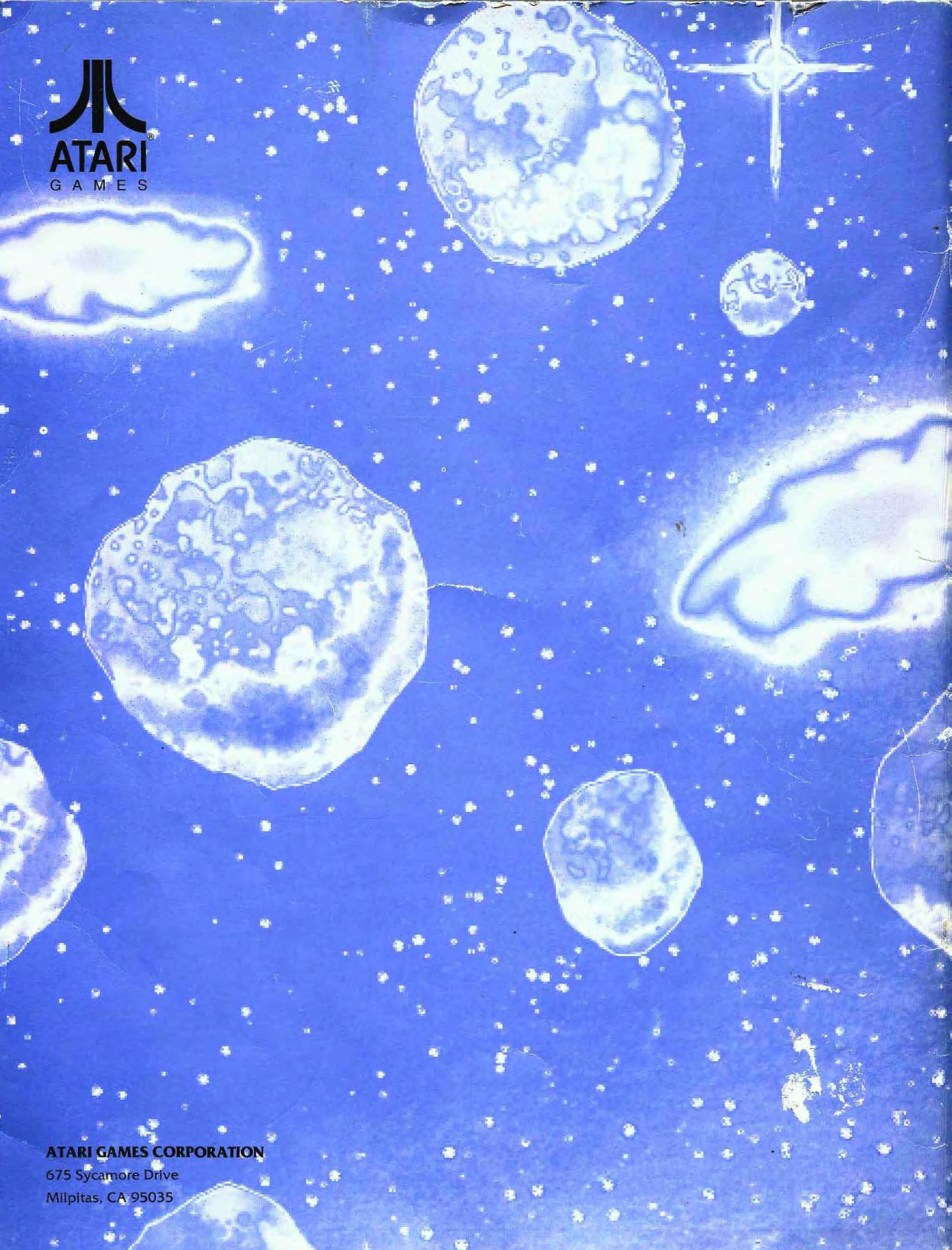
(c) Seller's examination of said products discloses to Seller's satisfaction that such alleged defects existed and were not caused by accident, misuse, neglect, alteration, improper repair, installation, or improper testing.

In no event shall Seller be liable for loss of profits, loss of use, incidental or consequential damages.

Except for any express warranty set forth in a written contract between Seller and Buyer which contract supersedes the terms herein, this warranty is expressed in lieu of all other warranties expressed or implied, including the implied warranties of merchantability and fitness for a particular purpose, and of all other obligations or liabilities on the Seller's part, and it neither assumes nor authorizes any other person to assume for the Seller any other liabilities in connection with the sale of products by Seller.

The use of any non-Atari parts may void your warranty, according to the terms of the warranty. The use of any non-Atari parts may also adversely affect the safety of your game and cause injury to you and others. Be very cautious in using non-Atari-supplied components with our games, in order to ensure your safety.

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